RESOURCES AND INDUSTRIES OF THE UNITED STATES

ELIZABETH F. FISHER

Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

http://www.archive.org/details/resourcesindustr00fishuoft

MODERN INDUSTRY (THE STOCKYARDS, CHICAGO)

RESOURCES AND INDUSTRIES OF THE UNITED STATES

BY

ELIZABETH F. FISHER

PROFESSOR OF GEOLOGY AND GEOGRAPHY, WELLESLEY COLLEGE

159010.
8.2.21.

GINN AND COMPANY

BOSTON · NEW YORK · CHICAGO · LONDON
ATLANTA · DALLAS · COLUMBUS · SAN FRANCISCO

COPYRIGHT, 1919, BY
ELIZABETH F. FISHER

ALL RIGHTS RESERVED

220.6

The Athenæum Press
GINN AND COMPANY · PROPRIETORS · BOSTON · U.S.A.

PREFACE

The attempt of the author has been to present to young people a vivid and accurate picture of the more important of the industries of the United States.[1] Further, the aim has been to show the factors, natural and economic, which have led to the development of these industries; to make clear the position which the United States holds in the world of commerce as a result of its great resources; to show the urgent necessity for the conservation of these resources in view of the complete dependence of our industries upon them; and to point out the means by which this conservation may be brought about. The text is designed for pupils of Junior High School age, seventh and eighth grades, to be used either as the only geography of the grade or as a supplementary geographic reader in schools where other geographies are in use.

The aim of the author has been not only to help the student, by word pictures and by many illustrations, to visualize industrial processes but to stimulate him constantly to think in the subject. The attempt has been, wherever possible, to lead the pupil, through questions, to work out for himself the reasons which underlie the location of industries, rather than to state them for him. Also, the entire subject has been presented as a series of problems, that the student may feel and live in the problems which confront the farmer, the manufacturer, and other producers.

The maps are modern, and many of them are unique. The rainfall map is modified from the 1917 rainfall map published by the Weather Bureau. The relief map is notable for the

[1] No attempt has been made to treat the industries of Alaska, Hawaii, and Porto Rico, the outlying possessions of the United States.

unusual accuracy and detail with which the western United States is portrayed, and the temperature map, for its clearness and simplicity. The soil map, which points out the distribution and origin of the soils of the United States is the first of its kind ever simplified for young people. By comparing these four maps — relief, soil, rainfall, and temperature — the pupil can see all the natural conditions which explain food production. Finally, the product map shows the result of the combination of these four factors in the crops which are produced in each region.

In the preparation of this book the writer is indebted to the members of the Department of Geology and Geography in Wellesley College. To Miss Mary J. Lanier thanks are due for able services in compiling statistics. The writer is indebted to Mrs. Helen Goss Thomas and especially to Miss Margaret Parker for their very able and friendly coöperation in the preparation of the text. Miss Parker also did valuable work in making the maps clear and simple.

Acknowledgment is due to Mr. Arthur O. Norton, Professor of the History and Principles of Education, Wellesley College, and to Miss Mary E. Keyes, of the Department of Practice and Training of the Boston Public Schools, for helpful suggestions in adapting the book to the interest of the student.

The relief map of the United States was constructed by Dr. Wallace W. Atwood, Professor of Geography in Harvard University, and is used by his courtesy.

The frontispiece was made possible by the courtesy of Armour and Company, of Chicago.

The chief sources for the book are the publications of the United States Geological Survey, the Department of Agriculture, and the Bureau of Mines, and the Report of the National Conservation Commission. For some of the valuable material on the conservation of natural resources the writer gives credit to Mr. Harlan H. Barrows, Professor of Geography in the University of Chicago.

ELIZABETH F. FISHER

WELLESLEY COLLEGE

CONTENTS

CHAPTER I. MAN'S NEEDS SUPPLIED BY NATURAL RESOURCES

PAGE

INTRODUCTION 1

CHAPTER II. SOILS—MAN'S CHIEF RESOURCE

How to conserve and increase the value of soils to man

HOW SOILS ARE MADE 5

KINDS OF SOILS 6

FOOD IN SOILS FOR PLANTS 9

Water as Plant Food 10

The watering of dry lands 13

The draining of wet lands 22

Minerals as Plant Food 26

Keeping soils fertile 27

CHAPTER III. FOOD—SOILS THE PRINCIPAL SOURCE

GRAINS: *How to supply the world with bread* 33

Wheat 33

How soil and climate locate the industry 33

Wheat-growing and harvesting 36

From wheat to bread 39

Corn 43

Where corn is grown 43

Planting, harvesting, and husking 45

How corn is used 46

Rice 48

Other Grains 51

SUGAR: *How to meet the growing demand for sugar* 52

Cane Sugar 54

Beet Sugar 56

Maple Sugar 60

Honey 61

PAGE

FRUITS: *How to supply fresh fruits the world over at any season* . . . 63
Our Fruit Lands 64
Protection against Frost 66
Fruit Transportation 68
Canning and Drying Fruits 69
Nuts as Food 71

VEGETABLES: *How centers of vegetable production shift with changing seasons* 71
Soil Products conserved by Protection from Insect Pests 74

ANIMAL PRODUCTS: *How to supply meat for the growing population* . 76
Beef; Cattle-Raising 78
Dairy Products 82
Lamb and Mutton; Sheep-Raising 84
Pork; Hog-Raising 87
Poultry and Eggs 88

CHAPTER IV. FOOD — WATERS AS A SOURCE

How we may use and protect our fish

FISHERIES 91
Fish of the Atlantic 91
Fish of the Great Lakes 94
Pacific-Coast Fish 94
Preserving Fish 94
Shellfish 96
Government Protection of Fish 98

CHAPTER V. CLOTHING — ANIMAL SOURCES OF SUPPLY

How to provide warm clothing for the world

LEATHER 100
Animal Skins for Boots and Gloves 100

WOOL 104
Sheep-Raising for Clip 104
From Wool to Cloth 106
Need for More Wool 107

SILK 108

CHAPTER VI. CLOTHING — VEGETABLE SOURCES OF SUPPLY

How to provide more and cheaper clothing for the world

PAGE

COTTON 109
Growing Cotton for Cloth 109
Cotton Manufacture 113
Other Uses of the Cotton Plant 115
Need for our Cotton in Europe 116
Danger to our Cotton Crop 116
FLAX AND HEMP 117

CHAPTER VII. SHELTER — SOILS AND ROCK THE SOURCE

How to secure building materials from our natural resources

LUMBER FROM THE FOREST 121
Our Forest Resources 121
How to care for our forests 125
Logging and making lumber 130
Building the house of wood 134
BRICK FROM CLAY 134
STONE FROM THE QUARRY 136
ARTIFICIAL STONE 138
STEEL 139

CHAPTER VIII. HEAT, LIGHT, AND POWER — MINERAL AND FOREST SOURCES

How to conserve the fuels needed by mankind

WOOD AS FUEL 141
COAL 142
How Coal is Formed 143
Mining Coal 146
How to Conserve Coal 151
PEAT 154

PAGE

PETROLEUM 156
Discovery and Early Use 156
How Petroleum is Formed 157
Locating and Drilling for Oil 158
Transportation by Pipe Lines 160
Uses of Petroleum 161
Danger of a Shortage 163

NATURAL GAS 165

WATER POWER — A SUBSTITUTE FOR COAL 166

CHAPTER IX. MANUFACTURED PRODUCTS — MINERAL AND FOREST SOURCES OF SUPPLY

How iron and fuel can be made to save man power

IRON AND STEEL 170
Essentials for all Industry 170
Sources of Iron 172
From Ore to Steel 173

COPPER 179
Regions of Production 179
Copper for the Future 181

ALUMINUM 181

OTHER METALS 182

AGRICULTURAL MACHINERY 182

RAILS, CARS, AND LOCOMOTIVES 183

SHIPS 185
Speed of Ship Construction 186
Electrically Propelled Ships 188
Where Ships are Built 188

AUTOMOBILES 188
An Assembling Industry 189

AËROPLANES 190

GLASS 192

PAGE

POTTERY 193

PAPER 194

Making Paper from Wood Pulp 194

Substitutes for Wood Pulp 197

CHAPTER X. OUR RESOURCES THE BASIS OF OUR TRADE RELATIONS

How trade unites the nations of the world

INLAND COMMERCE 200

Rivers and Canals as Trade Routes 201

Great Lakes Commerce 203

Transportation by Rail 204

OCEAN COMMERCE 208

Present and Future Trade 209

Development of Ports 213

CONCLUSION 220

APPENDIX — STATISTICS OF MANUFACTURES AND FOREIGN COMMERCE 223

INDEX 239

RESOURCES AND INDUSTRIES OF THE UNITED STATES

CHAPTER I

INTRODUCTION — MAN'S NEEDS SUPPLIED BY NATURAL RESOURCES

Man's chief needs. To live man must have *food*. No other possession is of any use if he must starve. For this reason the greater part of human work has been devoted to the production of food ever since man first inhabited the earth. To the men of the tropics food comes easily, for the continuous warm weather and the abundant rainfall provide a wild growth of fruits and vegetables which can be had for the taking. But the men of the cold regions find living more difficult. In the Far North, where the ice never melts, they can grow nothing, and so they must hunt and trap and fish, depending for sustenance upon the animal food which they can capture. Between these two extremes are the intermediate regions, in which live the majority of the people of the earth. Here the seasons follow one another in succession: the warm spring, the hot summer, the cool fall, and the cold winter. The warm seasons must be used to grow crops and supply food which can be stored for use during the cold winter season when the land produces nothing.

A second necessity to man's existence is *clothing*. It is a simple need in the warm regions, where the weather is so mild that a single garment of cotton or linen is all that he requires. But in the cooler climates more clothing is needed to keep men warm; the heavier woolen fibers must be used instead of cotton, and in the far northern countries only the fur skins of animals can keep out the cold. To provide themselves with clothing, men must grow cotton and flax, spin it into thread, and weave it into cloth; they must raise sheep, clip the wool, and manufacture it into woolen goods; or they must trap the wild animals, cure the skins, and fashion garments out of them for warmth during the long cold winter season.

From Richmond's "America and England"

FIG. 1. Navajo Indian home

Man's third need is for *shelter*, and this also varies with location on the earth's surface. In the warm countries a very simple hut of grass or straw will serve to keep off the rain and protect men against the beating rays of the sun. In the colder parts of the earth houses must be made of much stronger and more durable

materials, for they must protect men from the cold driving rains, chilling winds, and icy blizzards. Much of men's effort, then, must go into the building of houses in which they can live and work and into the

Courtesy of Atlas Portland Cement Co.

FIG. 2. Building walls of a modern house by filling forms with liquid concrete

manufacture of the materials out of which the houses can be made and supplied with the necessary furniture.

Industries to supply man's needs. These three fundamental needs of man—food, clothing, and shelter—form the main reason for all the work which is done in the world and for all the industries which are carried on. As the world civilization has grown, the three primary needs, which were at first so simple, have become very complicated and have led to the development of an enormous

number of industries. No longer will a few logs and a little mud plaster make a house that would satisfy the people of the United States. Housebuilding now includes the use of a countless variety of natural products and manufactured articles — wood, brick, cement, plaster, paint, nails, screws, iron pipes, copper wires, brass fixtures, and many more. This means that there must be mills to shape and finish the wood, brickmaking plants, iron and copper smelters, and all the other industries which contribute the different parts of which a house is made. The matters of food and clothing have progressed in the same way from simple problems to very complex ones, until a world full of industries has grown up, and with it has come the buying and selling which constitute the world's trade.

Natural resources. To supply all these needs men draw upon the storehouse of the earth. Beneath the surface is found a wealth of minerals, — coal, iron, copper, zinc, lead, gold, silver, and many others, — all of which are used in hundreds of different ways. On the surface of the earth is a loose, earthy material which is known as *soil*. This makes possible the growth of all the important foodstuffs and the clothing fibers as well as the great forests which provide lumber for building purposes. Flowing over the lands are the rivers, which furnish water supply for cities and towns, fish for food, and power to turn the wheels of the mills. All these things with which man is supplied by nature are called *natural resources*, and they constitute the source of supply for all his necessities and luxuries.

CHAPTER II

SOILS — MAN'S CHIEF RESOURCE

Problem. *How to conserve and increase the value of soils to man.*

Why we need soils. We have seen that man's very existence upon the surface of the earth depends upon the food supply which is the product of the soils. Thus, of all the natural resources soils are the most valuable. It is the responsibility of every one of us to find out how these soils can be best cared for in order that they may yield more valuable and larger and larger crops.

HOW SOILS ARE MADE

A long walk or drive across country shows us in some places bare hills or cliffs of solid rock; in other places we find forests; and in still others the surface is covered with grass or other vegetation. Forests do not grow upon solid rock, but in a fine material which is made up of loose particles of sands and clays formed by the crumbling of rocks. Besides crumbled rock material this also contains decayed vegetable matter. Some of these soils are found where they have been formed; others are found at varying distances from their source, and are known as *transported soils* because they have been blown by the winds, washed away by rains and rivers, or dragged along in or under the ice of glaciers, or have fallen down the mountains and hillsides.

KINDS OF SOILS

Sand soils. As we cross the fine white sandy soils they remind us of the broad stretches of sandy beach by the sea or lake shore. These soils are made up of grains of sand resting loosely on one another. Pure sandy soils are wet only while it is raining. As soon as the rain ceases to fall the surface sands are dry, because the water drains through them quickly and sinks to lower levels, where it is stored as *ground water*. Plants extend their roots downward for this water, which sustains them during periods of dry weather. Since the dawn of civilization men in the more unsettled portions of the earth have dug wells to get a supply of this cool, pure, stored water. We have seen that *sandy* soils are well-drained soils. They are of great value because of their underground water supply, but they are not very rich farming lands.

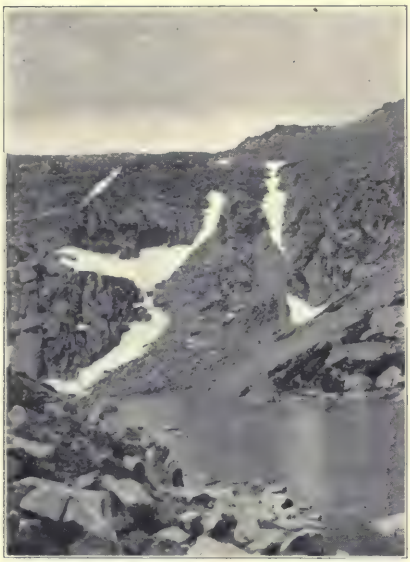
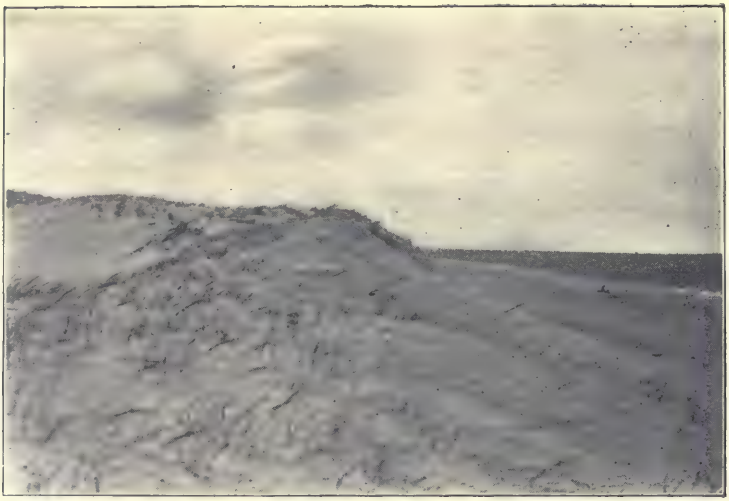


FIG. 3. Rocks crumbling and falling down mountain side

Clay soils. Some soils are frequently muddy, since they are made up of very fine particles packed so closely together that the water cannot drain through. During heavy rains these soils are therefore covered by pools or shallow lakes.



Courtesy of M. J. Ahern, S. J.

FIG. 4. Wind-laid soils

Courtesy of H. W. Dyer

FIG. 5. Rocks crumble to make soil

The water evaporates slowly, leaving wet, muddy soils into which carriages sink to the hubs of the wheels. Upon drying, the sun-baked surface shrinks and cracks irregularly, forming mud cracks. The soils of these areas are clays and differ from the sandy soils in that they are so fine-grained and poorly drained. They are formed from the crumbling of shale and many other rocks.

FIG. 6. Sun-baked clay soil, showing mud cracks due to shrinking from loss of water

In some areas sands and clays are found mixed together. This mixture is called *loam*. The term "loam" is also used to mean soil which contains much decayed vegetable matter. Such soil is rich in plant food and is excellent for farm lands because, since it is a mixture of sand and clay, it is neither so likely to suffer drouth as a sand soil nor so wet and cold as a clay soil.

These are only a few of the most important soils, but they show us that the soils of the United States vary greatly in material and fineness, according to where they are found and how they have been formed.

FOOD IN SOILS FOR PLANTS

All plants need three kinds of food — air, water, and certain mineral substances. *Air* is easily obtained and is taken into all plants by the leaves. *Water* is very important and is obtained through the roots, which reach down into the soil and take up the moisture.

© Fred H. Kiser, Portland, Oregon

FIG. 7. Thin mountain soils, Lake Chelan, Washington

But air and water alone do not make plants grow; there must also be certain mineral substances in the soil. Further, they must be in a form which is easily dissolved in water and can be taken into the plant by the roots. If soils are rich in these substances, they are fertile; according as they lack one or more of these substances they are less and less fertile.

WATER AS PLANT FOOD

Source of water for plants. The water which plants need comes from rainfall. A study of the rainfall map will show you that the rainfall of the United States is very uneven, varying from less than 10 to more than 120 inches yearly. It is heaviest along the northern

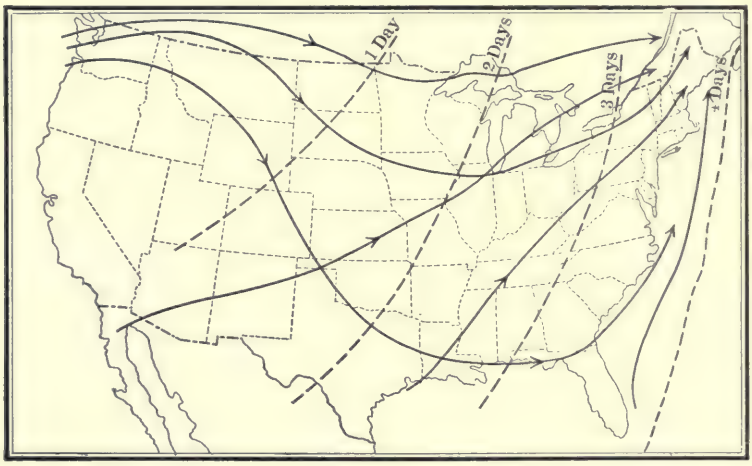


FIG. 8. Tracks taken by storms from west and southwest across the United States. Average distance traveled per day

portion of our Pacific coast. This region is situated where the westerly winds, coming from the Pacific, heavy with moisture, blow over it. Moving eastward these winds must ascend and descend the mountains and cross the plains. As the winds blow up the mountain side they reach a cooler atmosphere and are themselves cooled. This lessens the ability of the air to hold moisture, and so the water collects in drops and falls as rain on the Pacific slope.

RELIEF MAP OF THE UNITED STA

showing Physiographic Areas

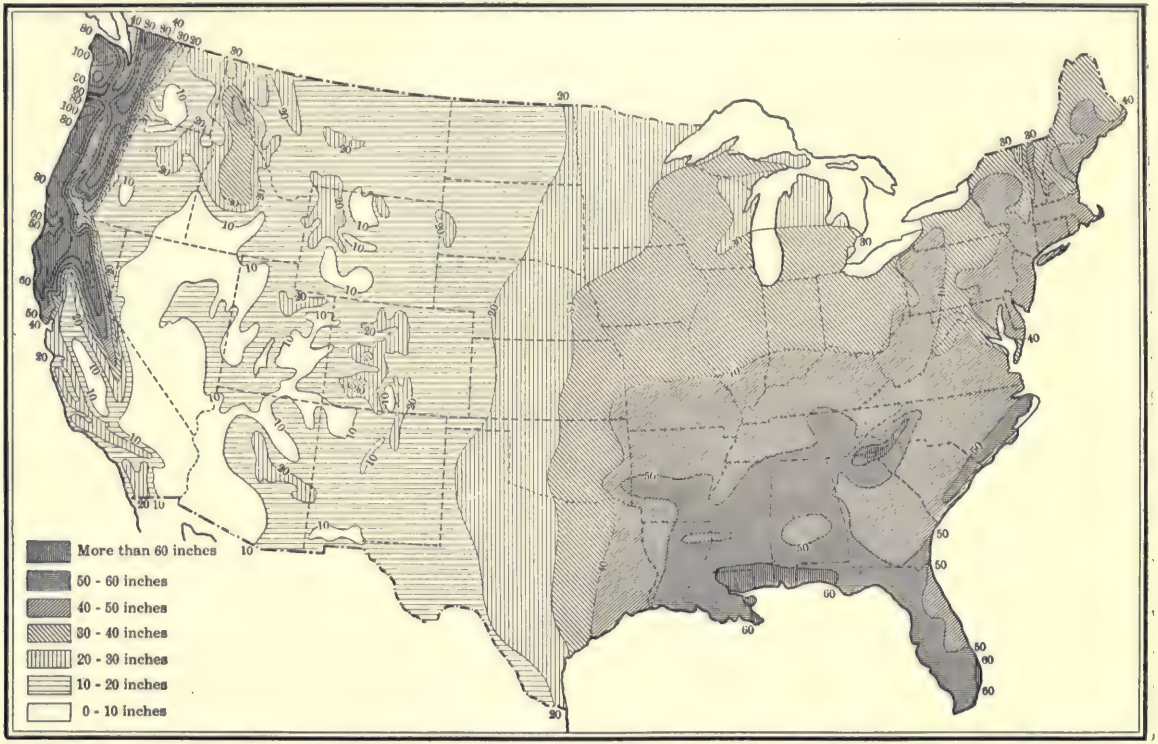


FIG. 9. Distribution of rainfall in the United States. (After United States Weather Bureau, 1917)

Having lost their moisture the winds are dry and have little water to carry over the Sierra Nevada to the regions which lie east. Therefore the lands between the Sierra Nevada and the Rocky Mountains are very dry, desert areas, and all the lands east of the Rocky Mountains would be dry, too, if there were no other way for them to get rain. But the rainfall map shows you that eastward from the Rocky Mountains it becomes more and more rainy, and Fig. 8 will tell you why. This shows the paths of storms which are constantly moving across the United States from west to east. As these storms move eastward, winds are drawn from all directions into the center of the storm. Those winds which are drawn from the south and east come from the warm waters of the Gulf of Mexico and the Atlantic, and are full of moisture. As they move northward and northwestward they are cooled, and drop their moisture as rain. All the lands east of the Rocky Mountains get their rainfall in this way. But they do not all receive the same amount. Find on your rainfall map the areas east of the mountains which have most rain and those which have least. Explain why.

In the areas of least rainfall the air and soil are dry and thirsty. Except for the northwest coast the seventeen most western states of the United States have so little rainfall that it is insufficient for farming. These areas are so dry that they are known as arid or semi-arid lands. They include millions of acres of fertile soils which need only water to yield an abundant harvest of grain or fruit.

The Watering of Dry Lands

In 1847 the Mormons in Utah made a settlement near Great Salt Lake. It was in the midst of an area too dry for crop raising. Soon they made the region productive by a simple method of conducting water to

Fig. 10. The barren desert, before irrigation

Fig. 11. The same land irrigated. yielding a rich alfalfa crop

these dry lands. They built dams across the mountain streams and made reservoirs to store the water. From these they allowed the water to flow through earth canals to the farms as it was needed. This practice of conducting water to the soils by canals or ditches, for the benefit of plant life, is called *irrigation*. By this process much dry land has been made into good farming land. A large portion of our dry lands can never be irrigated, because there is no water with which to irrigate. But it is believed that an area about the size of the state

of Oklahoma, or 45,000,000 acres, may be changed in the future from barren soils to richly yielding lands.

By irrigation, plants receive just the right amount of water at just the right time for their best growth. The

© Walter Lubken, Boise, Idaho

FIG. 12. Arrowrock Dam, Boise Project, Idaho. The highest concrete dam in the world, showing low-level outlets

farmer has no anxiety lest the rain may not fall or lest the rains may be so heavy as to flood the young plants. Day after day throughout the growing season the plants have abundant sunshine. In the Southwest, where the winter temperatures are warm, crops may be raised in winter as in summer, for the irrigation water may be had at any time. In many places in the warm Southwest five crops of alfalfa may be produced in one year.

Where the rainfall is less than 20 inches, as in the Great Basin region, irrigation is practiced as a necessity. Where the rainfall is heavier, as in the Middle West or along the Atlantic seaboard, it is practiced as a protection

FIG. 13. Irrigating an onion field by use of a canvas dam, Rio Grande Project, New Mexico

against a possible dry year. In still other sections, such as Florida, it is used to supplement the plentiful rain in order to produce the most abundant crops.

Irrigation projects. Since 1900 there has been a rapid increase in the irrigation of the Western lands. The work has been undertaken by individuals, companies, and corporations. Realizing the value of such work, the United States government, through what is known as the Reclamation Service, is now constructing reservoirs

and canals for thirty large irrigation problems, which are nearing completion. Locate these projects on the map showing irrigated lands (Fig. 14).

Strawberry Valley Irrigation Project. One of the most interesting of these projects is the Strawberry Valley

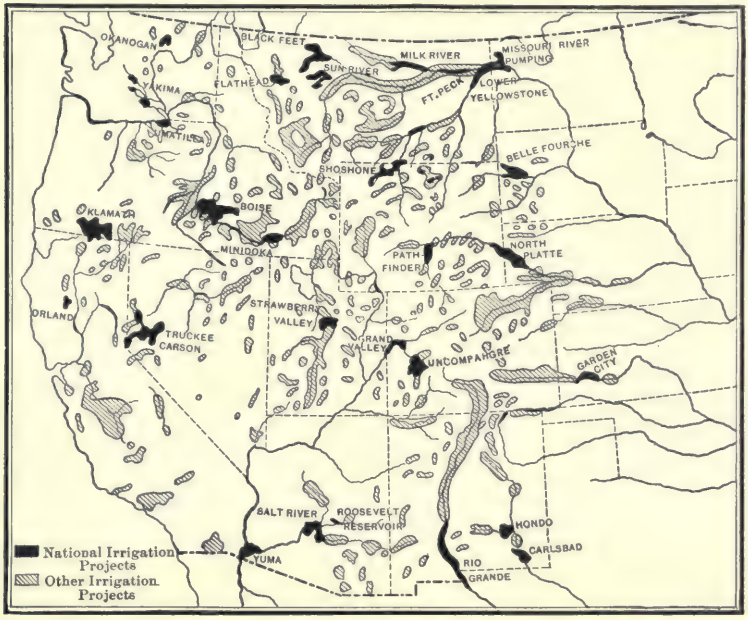


FIG. 14. Irrigated lands of the West

Project of Utah. Around the towns of Provo, Payson, and Spanish Fork (Fig. 15) is fertile land which can be made productive if only water can be brought to it. Some water is diverted from streams which flow into Utah Lake to irrigate a part of this area, and another part is supplied by water pumped from the lake. By these means 70,000 acres of land are watered. But to irrigate the other fertile lands of the region more water is needed. Therefore it is

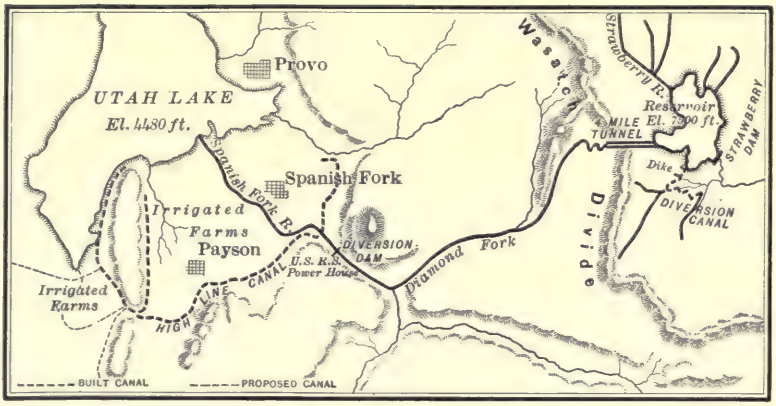


FIG. 15. Bringing water through the mountains to irrigate land

FIG. 16. Dividing water for irrigation and the making of electricity, Strawberry Valley Project, Utah

necessary to use the streams of another drainage basin. Over the Divide, on the eastern side of the mountains, is the Strawberry River, a branch of the Green River. It rises in the mountains, and its waters never fail.

FIG. 17. Taking water to the land from the irrigation canal, Strawberry Valley Project, Utah

Some years ago permission was obtained from the United States government for the development of a project to conduct water from the Strawberry River to the lands around Provo. A dam was constructed across the river and a large reservoir basin was filled, more than a mile above the sea (Fig. 15). Government engineers cut a four-mile tunnel through the Wasatch Mountains and built concrete canals to the towns. From these canals the individual farmer gets his water through a small

intake canal (Fig. 17). His method is to turn the water into many little furrows between the rows of crops so as to feed the roots of the plants. The amount he uses on his farm is measured by a meter, just as water and gas

FIG. 18. Sorghum grows luxuriantly on irrigated land. Strawberry Valley Project, Utah

are measured in our houses. By this project 60,000 acres of land have been turned into a rich agricultural area, supplying sugar beets, alfalfa, and hay. These fields, which formerly produced only from 15 to 30 bushels of wheat per acre each year, now yield from 40 to 50 bushels per acre. The fruit crops are also profitable in this region. Especially are the peaches of excellent quality.

Not only are these waters used for irrigation but some of them are diverted to a power house and used for making

electricity (Fig. 16). The latter furnishes light, heat, and power for various industries in near-by towns. Great sugar refineries have been built on these lands to extract the sugar from the sugar beets that grow here so abundantly.

© James McCulloch, Phœnix, Arizona

FIG. 19. Roosevelt Dam, Salt River Irrigation Project, Arizona

There are many interesting facts to note about other projects. The dry lands of south-central Arizona, on the Salt River, have been so successfully irrigated as to make possible the growth of Egyptian cotton of a superior grade. The largest reservoir in the world for water is on the Rio Grande in New Mexico. It holds two and a third times more water than is held by the great Assuan Dam on the Nile — enough water to irrigate 200,000 acres of land through two whole growing seasons. If the rain in this region should fail entirely for

one growing season, there would be a sufficient amount of water to produce plentiful crops.

How watering dry lands adds to our food supply. Because the population of the United States is constantly

FIG. 20. Desert lands made productive by irrigation, Strawberry Valley Project, Utah

increasing, there must be an increase in the food supply. In twenty years we may need twice as much food as we do now. This means that we shall need more farming lands to produce the food and must increase the output from these farms. These problems are bound to be solved in part by the irrigation of the arid lands of the West — lands which await only the life-giving water to bring forth crops of the finest quality and in the greatest quantity.

The Draining of Wet Lands

Lands too wet for farming. While in the West many lands are too dry and have to be watered, in the East many lands are too wet and have to be made dry. There are millions of acres in the Eastern United States

Courtesy of Wisner Estates

Fig. 21. Swamp grasses bordering a drainage ditch, Louisiana wet lands

that are known as "wet lands," — boggy lands, sometimes actually under water. They are covered with a thick, tangled growth of marsh grasses or thickets of swamp trees, as in the grassy Everglades of southern Florida and the cypress swamps of Louisiana.

Many are familiar with the salt marshes along the Gulf and Atlantic coasts, which are daily uncovered at low tide, — marshes which often extend many miles back

from the sea, along valleys and depressions. Along our rivers there are many meadow lands which are water-soaked marshes, so wet that the additional water which comes with the overflowing of the river during the flood season changes them into lakes. Throughout the

FIG. 22. A cypress swamp which might be made into rich farm land by drainage

northern and northeastern states there are innumerable lakes, bogs, and swamps — water-soaked areas which are being slowly filled in by vegetable growth. Of the 4000 of these lakes in the state of Connecticut 2500 have already been converted into bogs by nature. These lands are often so wet that it is treacherous to walk beyond the edge of the swamp, for one may disappear beneath the surface. Other lakes have a thicker mat of vegetation, which when jarred may be made to quake.

How man is benefited by draining wet lands. These swamps are a positive danger to the people living near by. Their stagnant waters are great breeding places for mosquitoes, which are not only a great pest in themselves but carry to people the dreaded disease malaria.

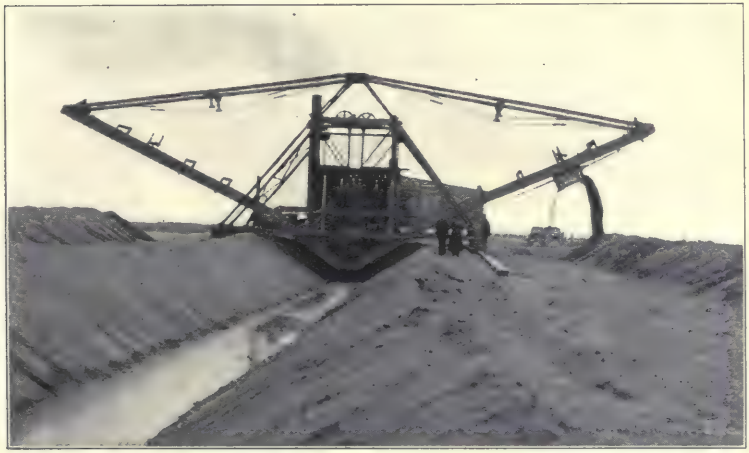
Courtesy of Wisner Estates

FIG. 23. A network of waterways provides cheap transportation from the farm to the world's market at New Orleans

New Jersey and South Carolina suffered so greatly that the marshes were drained, the breeding places for the mosquitoes thereby removed, and the danger of disease greatly lessened. Moreover, it is also a great waste of rich land to allow it to remain under water. A few of the sandy bogs along the Atlantic seaboard are used for cranberries, but in general the land is wasted. It is believed that by draining these lands we could add an

area of farming land to the United States which would furnish food and homes for a population of nearly 50,000,000 people. This is half the number of people living in the United States to-day.

Making wet lands dry. Let us consider how we shall drain our wet lands. In some places a simple ditch or



Courtesy of James S. Gibson

FIG. 24. Suction pump dredging a canal and building dikes

tile drain is sufficient to cause the water to run off. In others straightening a river or confining it within its channel will prevent it from overflowing. Millions of dollars have been spent in building up the banks of the Mississippi. In the future, when the need for land increases, the United States government may, like Holland, build dikes along the shore to keep the water out of our shallow sea areas and thus reclaim land now under the sea for farms and homes.

Products of drained lands. Fortunately these wet lands are so rich in vegetable material and other plant foods,

that when they are drained they give a large yield. They make the best of lands for truck gardening, farming, and fruit-growing. Sugar cane, cotton, corn, and rice thrive on the drained swamp lands of Louisiana. Along the

Courtesy of F. W. Rane

FIG. 25. Corn yields abundantly on reclaimed wet lands, Louisiana

southern Atlantic and Gulf coasts these lands are excellent for providing winter vegetables and fruits to meet the demands of Northern markets.

MINERALS AS PLANT FOOD

Soils made poor by one-crop farming. We have seen how, by irrigation or by draining, dry soils may be made moist and wet soils may be made dry. But even soils which contain just the right amount of water do

not always produce good crops. In the early days of American settlement people found that much tobacco could be produced on the rich soils of Virginia, but as they continued to plant tobacco year after year on the same soil the crop became smaller and smaller. This was because the tobacco plants had used up some of the mineral substances in the soil which plants need, and the plants could no longer flourish, because they could not get enough food. When the farmers left the old lands and planted their tobacco on new ones, the crops were again large, but many acres of land had already been ruined. The same thing happened in the cotton states of the South, where the farmers planted cotton year after year on the same land.

Keeping Soils Fertile

Now if these farmers, instead of moving to new land, had known how to put back into the soil each year what the cotton or tobacco plants had taken out, their lands would not have been ruined. Three of the mineral elements which plants need most are *phosphorus*, *potassium*, and *nitrogen*. These may be put into the soil in many ways — by plowing fish refuse into the soils, by spreading over the land barnyard manure or ground-up rock, which is rich in these elements, or by planting different kinds of crops in succession. All the substances which give back fertility to worn-out land are called *fertilizers*.

Where we get our fertilizers. There is now so much agriculture in the United States that many fertilizers are needed. Many of our Southern and Western states have large supplies of rocks rich in phosphorus. To

supply potassium for garden plots, farmers have long used wood ashes. But most of the potassium for use in this country has come from Germany. After the outbreak of the war the United States discovered many ways of getting potassium at home. The production grew so rapidly that in less than two years we have come to make enough to meet our own demands and no longer need to import any. In 1917 nearly half of all the potassium produced in the United States came from the salt beds of Nebraska; another region which is producing potassium from salt beds is Searles Lake, California. Cement mills are producing thousands of tons of dusts rich in potassium which are being used for fertilizers.

In the manufacture of sugar from sugar beets more and more potassium can be obtained from the waste liquid which remains after the sugar has been separated from the juice of the beet.

Large amounts of potassium are also being produced from giant kelp — seaweeds which grow in the shallow water along our Pacific coast in such quantities that seen from glass-bottomed boats they look like forests beneath the sea. Farmers who lived along the coast found that it benefited the crops to plow this seaweed into the soil. There are now companies which produce potassium from kelp on a commercial scale. Men go out in boats fitted with reaping knives which mow down the kelp and bring it back to shore. Here the weeds are dried and the potassium separated from them.

Many firms in Michigan and Wisconsin are producing tons of potassium from wood ashes. When the ashes are soaked in water the potassium they contain is dissolved. The potassium is then obtained by evaporating the water.

Making nitrogen of the air into food for plants. Though four fifths of all the air is pure nitrogen, plants cannot take it from the air, but only from the nitrates in the soil. Recently it has been found possible by means of electric furnaces to take this nitrogen from the air and make it into the nitrates which plants can use. For this work the United States government built recently large factories at Sheffield and Muscle Shoals (Alabama) and at Kingsport (Tennessee). Besides these the government is financing projects located at Saltville (Virginia) and at Niagara Falls (New York).

FIG. 26. Roots of red clover, with tubercles in which are the bacteria that collect nitrogen from the air

Another way in which the nitrogen in the air can be changed into nitrates is by tiny bacteria which live on the roots of certain plants. A very long time ago the Romans discovered that after such crops as clover, alfalfa, peas, and beans had been grown on their land, the soil was richer than it had been before. This was because millions of bacteria lived in little knots, or nodules, on the roots of such plants (Fig. 26). They take nitrogen

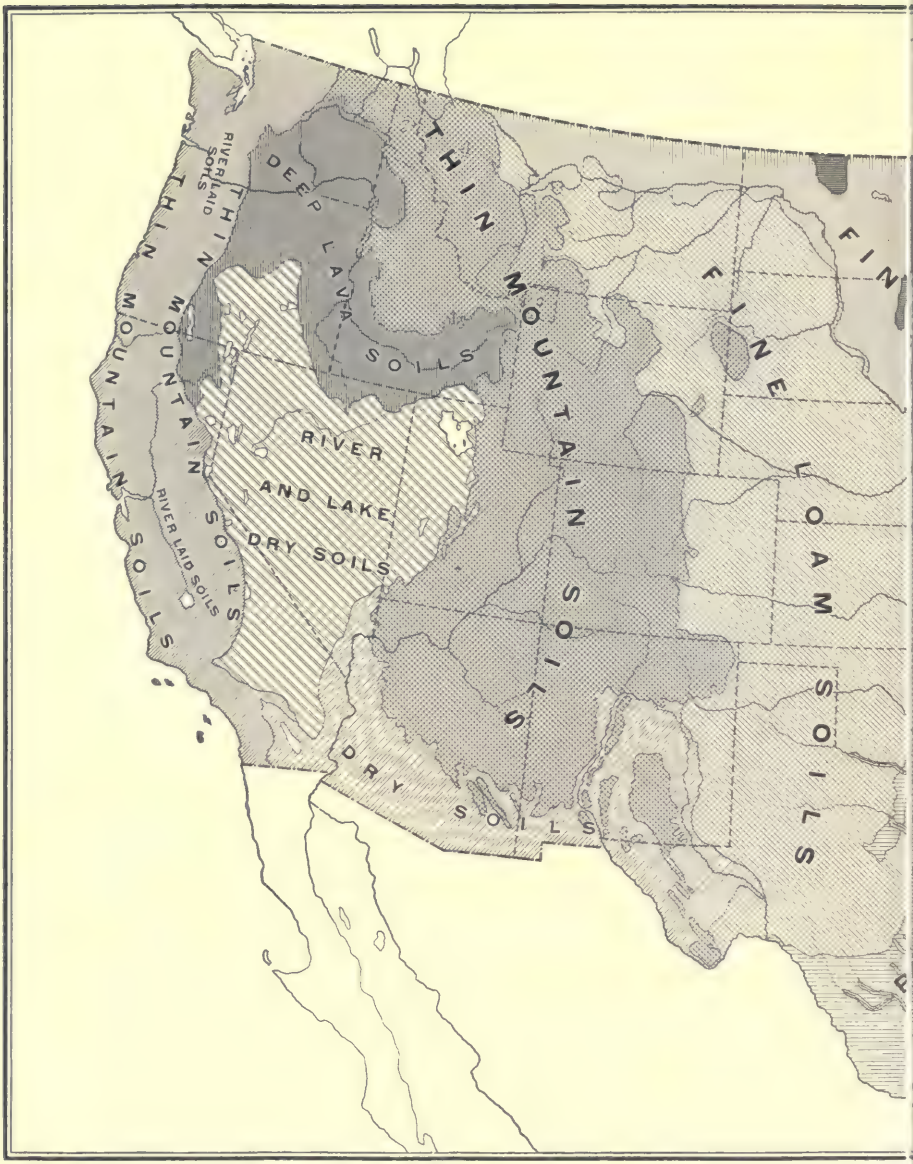
from the air and leave it in the soil in such form that other plants can use it. To-day the careful farmer who wants his farm to yield large crops often plants clover early in the season. Later he plows this into the soil

Courtesy of S. E. Lawton, M.D.

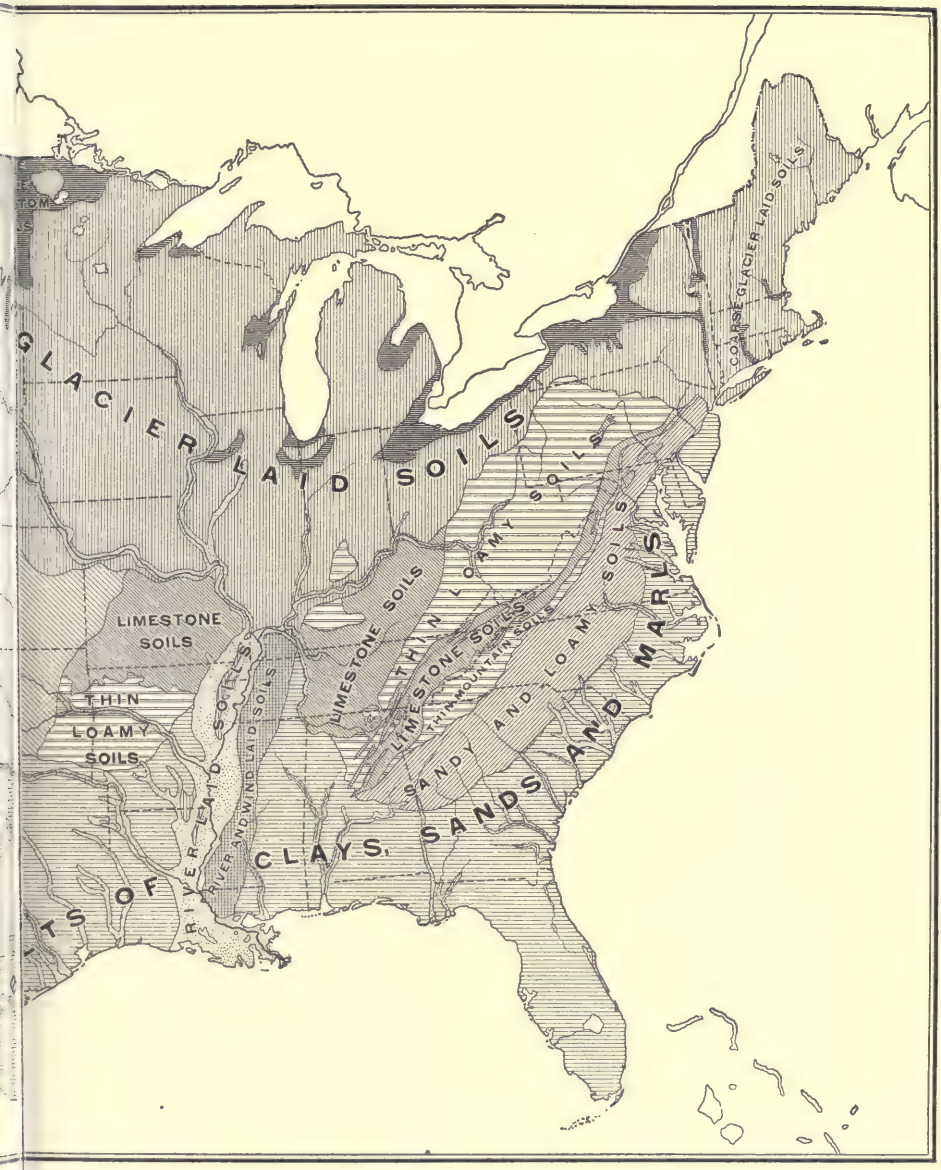
FIG. 27. Heavy crop of hay produced on river-laid soils, Brattleboro, Vermont

and plants a second crop — perhaps of corn. The nitrates which the clover left in the soil make the corn flourish. This is called *crop rotation*.

Food is our greatest need. Since it comes directly from the soil, we must try to keep our soils fertile, to make them yield larger and larger crops per acre, and to make every possible acre yield. Our government is taking means to supply water for dry lands, to drain wet lands, to provide fertilizers for all farm lands, and to teach farmers to rotate their crops. It is the duty of each one of us to help. In this way only can our



Soils of the United States. (A



United States Bureau of Soils, 1913)

soils be saved and made to produce food enough for the present and for the future.

Map study — Soils. Why do soils differ? How would a soil made from sandstone rock be different from one made from limestone? Which would be more likely to have in it all the kinds of food that plants need, a soil made from one kind of rock or from many kinds of rock? Describe at least three ways in which soils made from many kinds of rock are brought together in one place.

Courtesy of M. J. Ahern, S.J.

FIG. 28. Fine glacial soils

Find the areas of river-laid soils (see soil map). Explain their shape. From what regions have the river-laid soils along the lower Mississippi been gathered? Why are these lands good farm lands?

When rivers flow into lakes they drop the soil they carry, spreading it smoothly on the bottom of the lake. If the lakes dry up or are drained, these soils are uncovered. Find on the soil map the regions having soils of this sort. What is their value to man? See product map (Fig. 80) for kinds of crops produced in these areas.

Another way in which soils made of many kinds of rock may be brought together is by glaciers. Long ago a great thick sheet of ice, called a glacier, spread from Canada over the northern United States. This mass of ice dragged with it much loose rock material. Some of the pebbles and large pieces of rock, as they were dragged

along, were rubbed together until they were ground into fine rock dust. When the glacier melted, this loose rock was left as soil on the land the glacier had previously covered. In some regions most of the rock left was finely ground material, but in others many pebbles and large boulders were left.

Locate on the soil map the area which the glacier covered. Find on the product map (Fig. 80) for what these glacial soils are used.

Fig. 29. Coarse glacial soils

What part of the region covered by glacial soils is good for farm lands? Why? Look again at your soil map and explain why the products of New England differ from those produced on the more western glacial areas.

In regions to which winds, rivers, or glaciers have brought no soils how must the soils be made? Find some regions where the soil must have been so made. In some of these areas the soils are very thin. Find these regions and tell why their soils are thin. See relief map and Fig. 7. Do you think these lands are good for farming? Why? See on your product map for what they are used.

Even where these soils are deep they are not always fertile. Can you tell what would make some soils poor and others good? Account for the several kinds of soil on the coastal plain. Soils made from limestone and from lava are in most cases fertile, particularly for certain kinds of crops. What is produced on the limestone soils of Kentucky?

See Fig. 9. Locate areas which in spite of rich soil are not good farm lands. How can they be made to produce?

CHAPTER III

FOOD — SOILS THE PRINCIPAL SOURCE

GRAINS

Problem. *How to supply the world with bread.*

WHEAT

Grass seeds for food. Long ago the native tribes along the eastern shore of the Mediterranean discovered that the seeds of the wild grasses were good to eat. Therefore they gathered the seeds, ground them between stones, mixed the meal with water, and baked it into very good bread. This suggested planting the seeds and growing more of these grasses, in order to have food for the tribe. To-day the seeds of the grasses are known as *grains*. Those upon which we depend most largely for food are wheat, corn, rye, oats, barley, and rice.

How Soil and Climate locate the Industry

Wheat in New England. Of all the grains wheat is the most important. It has become the chief food for one third of the human race. It was brought into America by the colonists, who succeeded in producing crops in New England and some of the states to the south. But the small farms of the East were never really suited to wheat production because the land is too rough, the soils too coarse, and the rainfall of the late summer too heavy for its best growth.

Where to plant wheat. Although wheat can be produced in many widely differing regions, it can be most easily planted and harvested where the surface is level, and it yields best where the soil is fertile, fine, and deep. The climatic requirements for wheat are much more exacting than the soil requirements. Wheat needs only from three

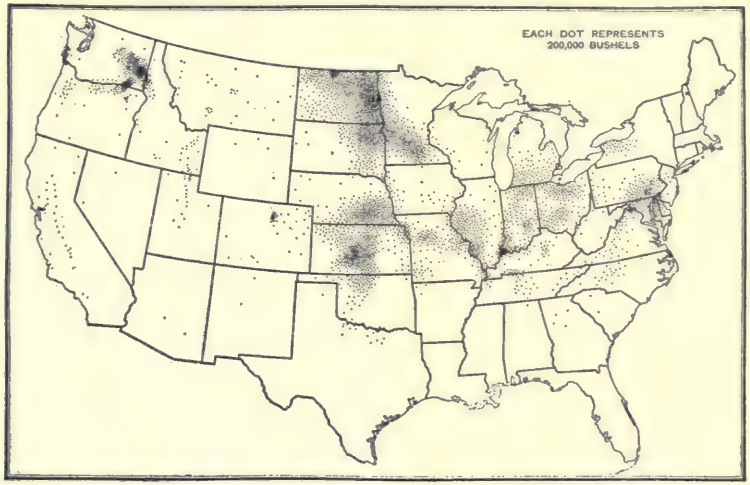


FIG. 30. Production of wheat in the United States

to four months of weather without frost in which to grow and ripen. The early part of this growing season should be cool and rainy, so that each little plant will send up many stalks; but later, when the grain is ripening, the weather should be warm and dry. If it is too rainy the grain may spoil while still in the field, and the fields will be too muddy for the harvest. Regions which have between 20 and 30 inches of rainfall, with most of it in the early part of the growing season, are excellent areas for wheat.

Map study. Find on the rainfall map (Fig. 9) regions which have the right amount of moisture for wheat to yield best. Look at the soil map to see whether or not these regions have favorable soil. The relief map will show you the kind of surface in each of these areas. Make a list of the states which you think are best suited to produce wheat. In what other areas may wheat be produced by irrigation? Correct your list by studying Fig. 31.

Winter and spring wheat. In the southern part of the wheat belt, where winters are mild, wheat is planted in the fall, usually in September or October. It grows two

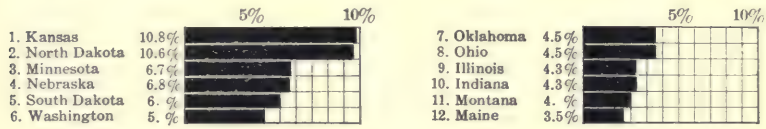


FIG. 31. Leading wheat-producing states

or three inches before the first frost. It is hardy enough to withstand the snow and freezing weather, and begins to grow again in the spring when the frost is out of the ground. It matures in June or July. Wheat planted in this way is called *winter wheat.* In the colder, northern states of the wheat belt the grain is planted after the snows melt in the spring, and soon sprouts. Such wheat is called *spring wheat.* The spring wheat is ready for harvest from four to six weeks after the harvesting of the winter wheat. Spring wheat makes the best flour for bread, while winter-wheat flour is excellent for pastry. In the most western states of the plains, where lands are drier, a hard variety of wheat called *durum* thrives. This is much used for macaroni.

An ideal wheat country. Of all the wheat areas the valley of the Red River of the North, in Minnesota and North Dakota, is the best. Here farms are developed on a

vast scale. Any single ranch may stretch over thousands of acres of land, and each possesses the many horses and machines needed for the planting and harvesting of wheat. So level are these lands that when the rainfall is heavy the surface of the land is one vast sheet of water. We may ride for days across the broad flat plains which stretch away endlessly in all directions, resembling the level surface of the sea. Now and then, at intervals of half a mile or a mile, the scene is varied by a group of poplar trees which have been planted as shade for a little group of buildings consisting of the ranch house, a windmill, and stables for horses and cattle.

Wheat-growing and Harvesting

Wheat-planting. In the planting season we may see many plows drawn by from three to six horses sweep across the fields, cutting furrows. These are followed by harrows which, with saucerlike disks, break up the lumps of earth and separate them into fine particles. Into the harrowed ground machine drills drop the wheat seeds, covering them with earth.

The growing season transforms the land into golden fields of waving grain. By harvest time the wheat heads are heavy with precious seeds. During this growing season there has been no work for the farmers in the wheat fields, but as the time approaches for the great reaping machines to begin their work many laborers are needed. So many workmen as are required for the harvest would be idle much of the time if they lived all the year upon the same farm. Hence many bands of laborers move from ranch to ranch, stopping on each just long enough to harvest the grain. They begin in the

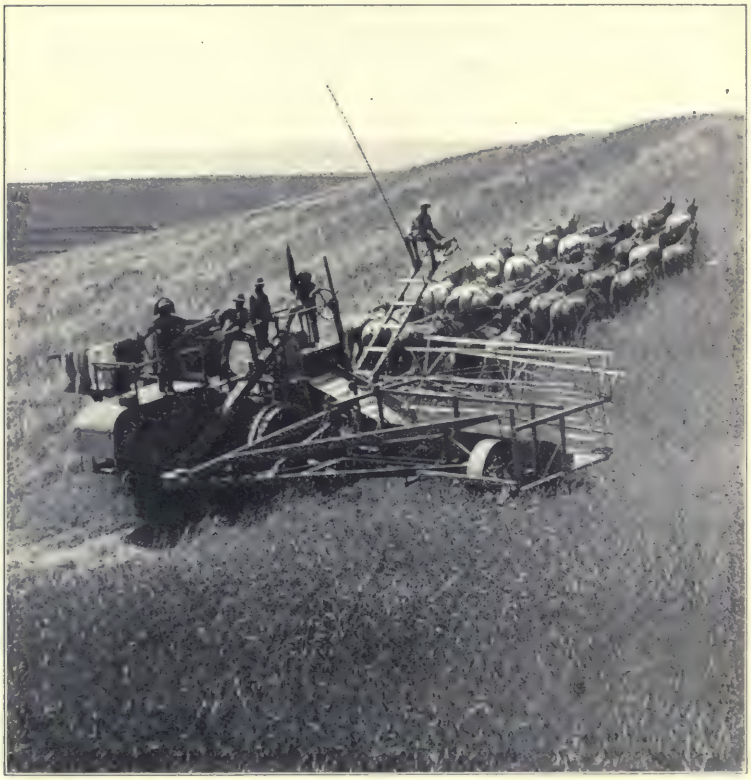
South, where the wheat matures very early in the season, and, as the summer advances, move farther and farther north until by early autumn they have reached the fields of the Red River Valley.

Harvesting. When these workers arrive, the harvesting begins. First the great reaping machines, drawn by two,

Fig. 32. Plowing by caterpillar traction engine

four, six, or even thirty horses sweep back and forth across the fields. They cut and gather the stalks, bind them into bundles, and stack these bundles on the ground at regular intervals. The grain in the stacks is allowed to dry. Then the seeds are separated from the straw by large steam or oil-burning threshing machines. Some machines are combined reapers, binders, and threshers; they move across the fields, cutting the grain and threshing it at the same time.

More and cheaper wheat. These big modern machines are a triumph of inventive skill. Without them the grain production on any such large scale would be quite



© Underwood & Underwood

FIG. 33. Harvesting in Western wheat fields, Walla Walla, Washington

impossible. To cut the stalks by hand with an ordinary scythe, as is often done on small farms, and then gather them up in bundles, bind them with string, stack the bundles, and beat the grain free from the heads with flails would be an endless task. By hand labor the individual

farmer would be fifteen years in growing for the market an amount of wheat which by the aid of machinery he can produce in one year. The invention of the McCormick reaper and other machinery made it possible to

Courtesy of H. J. Waters

FIG. 34. Threshing wheat

produce wheat much more cheaply on these great Western ranches than it could be produced by hand labor on the smaller farms of the East.

FROM WHEAT TO BREAD

Storing the grain. Once the grain is harvested it must be stored until it can be sent to the manufacturing and transportation centers. Therefore each town must have its temporary storage house for the grain. These are known as *grain elevators*. They are often from 10 to 12 stories high. If we enter one of them we find a group of steel grain bins surrounded by brick or concrete fireproof walls, with machinery at the top for loading and unloading the grain. Millions of bushels of wheat are stored in these elevators until it is possible to ship them to the market. They often hold 3,000,000 or more bushels of grain and can be loaded and unloaded with astonishing

rapidity. If the grain from one of these elevators were made into bread, it would supply a city of about 600,000 people for a whole year.

Making flour. From the grain elevator the wheat is sent to the mill, where the hard grains are cleaned and then ground by steel rollers. These crack the grains

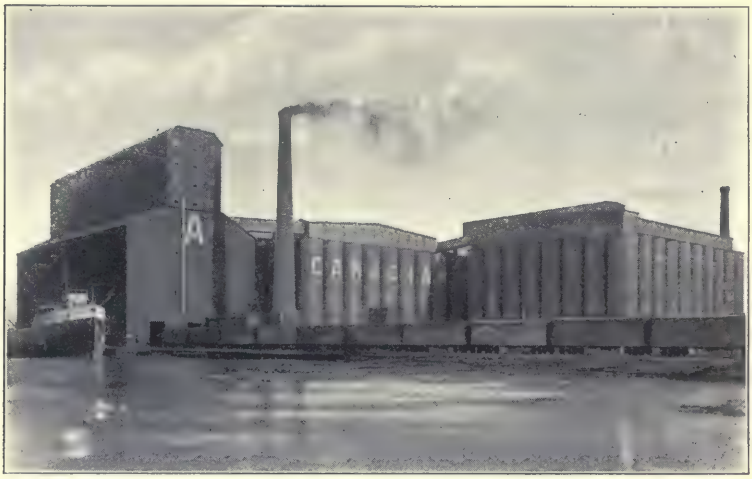
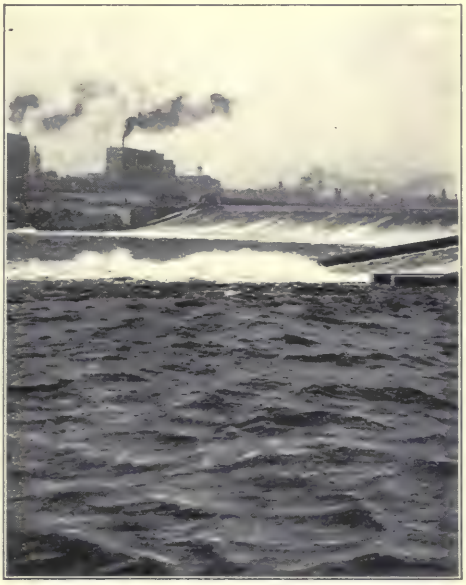


Fig. 35. Grain stored in elevator awaiting transportation

and separate the outer husks, or bran, from the inner starch and gluten. After the wheat has passed through six grindings, and has been many times cleaned and sifted (bolted), it is packed to be sold as flour. Minneapolis is the greatest milling center of the world. Its mills are run by the water power of St. Anthony Falls and produce 80,000 barrels of flour a day. Much of the wheat of the great spring-wheat belt goes to Minneapolis to be made into flour. This is not only because of the water power there but because Minneapolis lies on the eastern border of this belt, so that the wheat can easily pass

through this city on its way to market. Also there are excellent transportation facilities, by rail or by boat, in every direction. Although Minneapolis is the most important milling center, there are many others. In the United States there are more than 12,000 flour mills.

Distributing wheat and flour. The flour that has been made in Minneapolis, Buffalo, St. Louis, Milwaukee, New York, and the other milling centers is constantly moving outward in carloads and boatloads from these places to other great cities for distribution. Wheat is one of the easiest of all grains to transport long distances, because it does not spoil easily. Furthermore, one hundred dollars' worth of wheat weighs less and takes up less room than one hundred dollars' worth of corn or other grains and can therefore be more cheaply shipped.



© Underwood & Underwood

FIG. 36. Manufacturing flour by water power, Minneapolis

Feeding other countries. Not only is wheat sent to the great cities of our own country but it is an important export. It enters much more largely into the commerce of the world than any other cereal. From San Francisco and Puget Sound ports it is shipped to Japan. From

Atlantic and Gulf cities it is sent to South America and Europe. To-day wheat is moved from the region where it is harvested to the place where it is used without once being touched by hand. This shows how very much work formerly done by hand is now done by machinery.

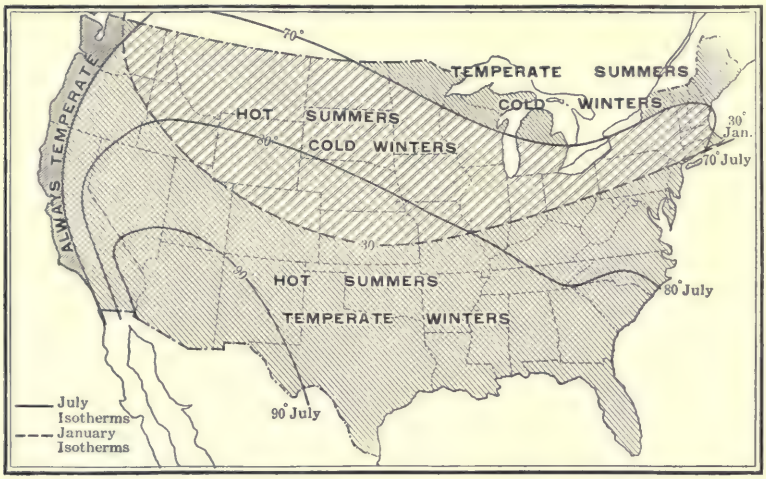


Fig. 37. Average seasonal temperatures of the United States

Since transportation has thus been made easy the billion bushels of wheat which the United States produces each year can be made into bread not only for the people of the United States but for those of many other lands.

Map study. Locate on the temperature map (Fig. 37) the regions which have the mildest temperatures throughout the year. Locate those regions having the greatest extremes of temperature. Compare the location of the temperature areas with the parallels of latitude.

This comparison shows you that difference of latitude is not the only cause for differences in temperature. Along the Pacific coast, over which the winds from the ocean blow, the temperatures are always mild, because in winter these winds have been warmed by

the warmer ocean, while in summer the water is cooler than the land and the winds which blow over it are cooled. The interior of the continent far from the ocean is not influenced by sea temperatures. During the long nights of winter the land cools more than it can be warmed during the short day, and so it grows colder and colder. In summer the land is warmed more during the long sunny days than it cools in the short nights, and so becomes hotter and hotter.

The ocean becomes neither so hot in summer nor so cold in winter as the land, because the waters of the ocean constantly move and mingle with waters from colder and warmer regions. As soon as the water in one place becomes cold it either sinks and is replaced by warmer water from below or moves away to other regions.

From what direction do winds blow over the Atlantic coast? Why are temperatures along the Atlantic coast not like those along the Pacific?

CORN

Indian corn. When the wheat which the early American settlers brought with them from Europe failed to thrive in New England, the colonists might have starved had it not been for a new grain known as maize or corn, which the Indians showed them how to grow. Corn was much better suited than wheat to the rough soils of the New England hillsides, and it soon became the chief food of the colonists.

Where Corn is Grown

Reasons for the corn belt. But even corn does not thrive best under such conditions. It too yields better on the level fertile lands farther to the west. Corn does not mature so quickly as wheat and can ripen only in regions where for five months there is not a single frosty night. Corn also needs more rainfall than wheat and needs it in frequent showers followed by hot sunshine throughout the growing season. It was natural, then, that as

people moved westward into Ohio, Indiana, Illinois, and Iowa more corn was produced than had ever been grown in New England, and these states formed the great United States corn belt of which to-day we are justly proud.

Courtesy of H. J. Waters

FIG. 38. Selecting seed corn

Corn the leading crop. The great production in these states has made corn the largest and most valuable of all American crops. Each year the United States produces about 3,000,000,000 bushels of corn — a crop three times as large as the wheat crop and three fourths of the total corn crop of the world.

Map study. Locate the corn belt (see Figs. 39 and 40). Why does not the corn belt extend farther north? What climatic conditions determine the western limit of the corn belt? Why does production decrease eastward from the chief corn states? southward? (See Fig. 92.) Why does the corn belt lie south and east of the spring-wheat belt? How may corn production be increased?

Planting, Harvesting, and Husking

Growing the corn. The soil is made ready for the corn, and the grain is planted by hand or by corn planters in

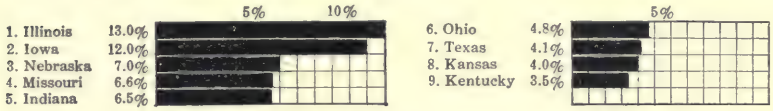


Fig. 39. Leading corn-producing states

rows from three to five feet apart. But the work in the cornfield is not finished when the planting is done. For weeks after the young plants appear the field must be

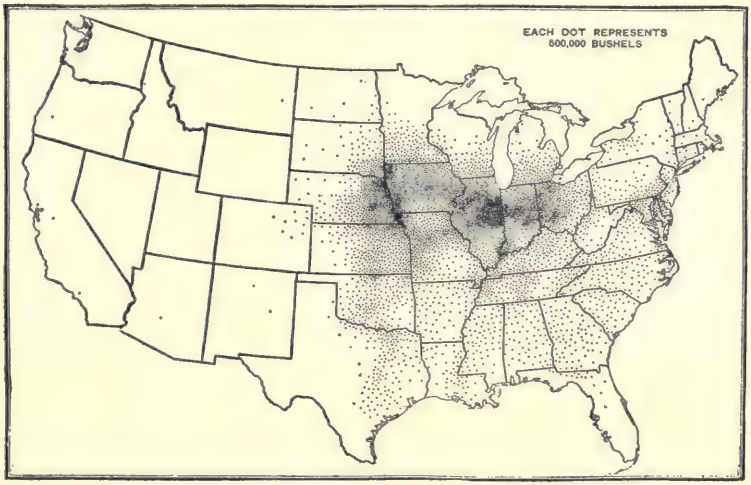


Fig. 40. Production of corn in the United States

kept free from weeds by frequent plowing between the rows until the corn plants are strong. For this reason one farmer cannot take care of so many acres of corn as of wheat, and the farms of the corn belt are not so large as the great wheat ranches of the Northwest.

The cornfield. During the hot summer days all through the corn belt one may see vast fields stretching away as far as the eye can reach, — row after row of tall corn with stately stalks from 8 to 12 feet in height. One can often hear a rainstorm coming a long way off by the pattering of the big drops on the broad corn leaves. After the storm the glossy dark-green leaves glisten in the sun.

FIG. 41. Corn shocked and the ears husked

The harvesting. At harvest time the fields are dotted with huge shocks of ripe corn which are left by the big binding and shocking machines. Often the ears are picked off before the corn is shocked and the stalks are either cut by hand later or left in the field and plowed under. Formerly everybody helped in the husking, and the young people of the neighborhood often gathered together for the jolly husking bees. Now corn-picking is done largely by machine and the corn is husked by machine shredders, which shred the stalk and husk the corn.

How Corn is Used

Food for stock. Corn is the great feed crop of the nation. Unlike wheat, it can only with difficulty be transported long distances, because it is heavy and bulky

and spoils quickly when packed. Moreover, it is not in great demand for human food, because it does not make such light bread as wheat does. Therefore only two and one-half per cent of the United States corn crop is sent to other countries, and four fifths of it is used where it is grown, for the feeding of cattle, sheep, and hogs. Nearly one half of all the crop is fed to hogs alone in the corn belt.

Fig. 42. Blowing the chopped corn into the silo

Saving waste. Farmers used to allow the cornstalks to go to waste. When the fields were being made ready for the spring planting, great fires of blazing cornstalks might be seen all round the horizon. But now the whole plant — ears, stalk, and leaves — is used for feed for stock. The grain is fed either on the ear or shelled. Sometimes after the ears have been gathered the cattle are turned loose in the cornfields to eat the dry stalks and blades. Those which they do not eat during the winter the farmer plows under in the spring to fertilize his soil. Sometimes the stalks are cut and fed to the stock like hay.

Silos. Often the whole corn plant is chopped fine while it is still green — ears as well as stalks — and stored for winter use in tall tanklike bins made of wood or concrete

called silos. The material is carried from the chopping knives to the top of the silo in buckets fastened to an endless moving belt. A newer and better way is to blow the cut fodder into the silo through an iron pipe by a powerful blast of air. Material so stored is called silage. It is excellent winter food for dairy cattle.

Other uses. The small part of our corn crop which is not fed to live stock is used in many different ways. All parts of the plant are utilized. Much corn is raised in our gardens to be used green in the form of roasting ears, and much of this corn is cut from the cob and canned for winter use. Some of the grain is ground into meal to be used for bread. The kernel is also used in the making of corn sirup, cornstarch, laundry starch, hominy, and corn oil, which is one of the most valuable corn products. Mixed with finely ground leaves and husks it makes an oil cake, which is fed to chickens and cattle. The corn silk is used as filter, the husks for making mattresses, the cobs for corncob pipes, and the outer parts of the stalk for varnish. Corn has won first place among our cereals, not only because it is our largest and most valuable crop but because of the very many purposes it serves.

RICE

How we use rice. Rice is the principal food for more than half the population of the earth. It is of great value as food because of the heat and energy it gives the individual and the ease with which it is digested. The peoples who live chiefly upon rice are those of India, China, and Japan. To us it is familiar as a cereal, a vegetable, and a dessert, and in the form of cakes

and candy. Rice straw is used for the making of paper, and the bran and hulls are used as fuel in rice mills and as stock food.

Rice brought to America. Rice was introduced by accident into South Carolina in 1694, when a steamer bound

© Underwood & Underwood

FIG. 43. Transplanting rice shoots in Japan

for Liverpool from Madagascar was blown out of its course and put in at Charleston. The captain gave a small parcel of rough rice to the colonists, and its cultivation soon supplied the colony with food.

Where rice grows. To-day fields of growing rice are a very common sight along the coast and river lands of Louisiana, Texas, California, Georgia, and South Carolina.

Rice is a grain of the tropics, and therefore in our country it grows best in those regions which all the year round are rainy and warm.

Locate on Fig. 80 the regions where rice is produced. By comparing this map with the rainfall and temperature maps (Figs. 9 and 37) explain why each of these regions is suitable for rice. In what way does the California Valley differ from the other regions where rice is grown? How is production made possible here?

The farmer's problem. In these warm, wet lands of the Southern states many of the rice farms are small, covering only from ten to one hundred acres. The fields are planted by the middle of April, and when the rice sprouts water is lifted by powerful pumps from the rivers or wells of the region to flood the fields. The lands are kept under water until the weeds are killed. The water is then allowed to run off the fields back into the rivers, and the land is dried and hoed. Again the fields are flooded, and are kept so until the grain is ripening.

It was long necessary to do the work of planting and harvesting the rice by hand, but now on the heavy clay soils of the Texas and Louisiana prairies the crop is planted and reaped by machine drills and binders like those which plant and cut the wheat on the ranches of the Red River Valley.

Preparing for market. From the fields the rice is taken to the mills for threshing, cleaning, and husking, and finally each little grain is polished, and the rice is graded, weighed, and packed for market. Many of the mills in the United States turn out from 1000 to 10,000 bushels of rice every twenty-four hours.

The reclaiming of the wet lands of Louisiana, Texas, Alabama, and Mississippi will open up millions of acres,

upon which a rice crop worth, probably, half a billion dollars may be produced. The importance of this is very great when we realize that the quantity of rice raised on one acre has a food value five times as great as the amount of wheat which one acre yields.

OTHER GRAINS

Other grains that are grown in the United States are oats, barley, rye, and buckwheat. All of these are hardier than wheat and may be grown under more severe conditions. *Barley* is grown 150 miles north of the arctic circle. It is very commonly used for horse feed in the California Valley, because it is the only one of all the cereals which never fails to produce a crop on these dry lands, even without irrigation. Half the American barley crop is grown in the area from central Dakota to Milwaukee, where it is brewed into beer. *Rye* is commonly made into flour and makes the well-known black bread so much used in Germany and Russia.

Oats are the common feed for horses, and oatmeal is a most healthful breakfast food. The use of oatmeal flour in the making of bread and cake has increased rapidly during the last ten years. Driving through the corn belt early in July we see on one side of the road fields of ripening oats, and on the other young growing corn. Later in the month the oats are harvested before the laborers are needed for the reaping of the corn. Thus by planting the two on the same farm the farm hands are kept busy all through the season.

Buckwheat is made into flour and is used chiefly for griddlecakes. New York and Pennsylvania are the chief producers of buckwheat, supplying more than half our crop.

SUGAR

Problem. *How to meet the growing demand for sugar.*

Why conserve sugar for to-morrow. The supply of sweets — sugar, sirup, molasses, and honey — must be increased if we are to meet the growing demand in this country and abroad, or we must conserve our supply

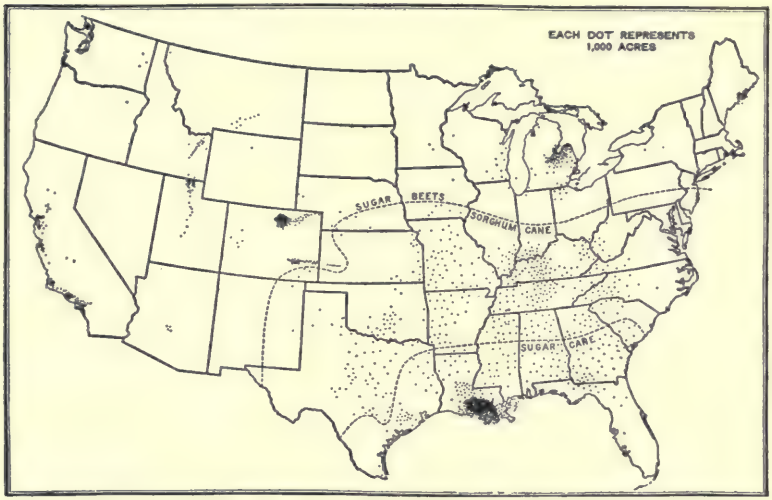


FIG. 44. Production of sugar beets, sorghum cane, and sugar cane in the United States

by using less. The consumption in the United States is enormous. On an average each man, woman, and child consumes 85 pounds of sugar a year, or a quarter of a pound each day. This means that each one of us uses twice as much as each person in France and five times as much as each person in Russia. One fifth of all the sugar used in the world is consumed in the United States.

Supply of sugar. Of the amount we use the United States, together with Hawaii, Porto Rico, and the Philippines, produces about one half. For the other half of our supply we depend upon Cuba. If we are to meet the future demands of the ever-increasing population, more sugar must be produced.

© Underwood & Underwood

FIG. 45. Planting sugar-cane stalks

Sources of sugar. Though sugar, like starch, is found in small quantities in almost every vegetable, the chief sources of our supply are sugar cane and sugar beets. In prehistoric times the sugar supply came from honey. Maple sugar is extracted from the maple tree, and date sugar from the date palm. As late as 1793 it was date sugar brought from the Mediterranean which supplied the London market. Then sugar was a luxury used only for flavoring. It was not until 1850, when steam power began to do the work of horse power in making sugar and the use of steam lowered freight rates, that sugar was so reduced in price as to become a staple article of food in every household.

CANE SUGAR

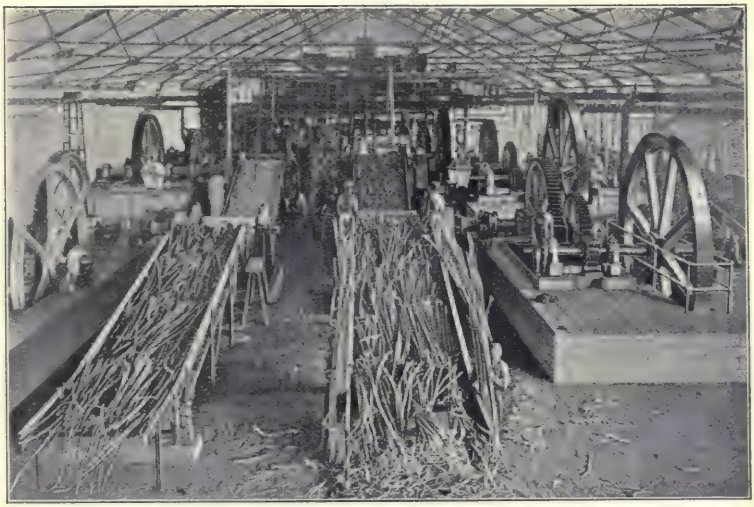
Introduction of sugar cane into the United States. Sugar cane was introduced into the American colonies by Jesuits from San Domingo in 1751, but it was not until the introduction of "purple cane" in 1820 that the production was of any importance in the United States. Up to this time the need among the colonists for sugar was supplied by the rich cargoes of molasses and sugar brought from the West Indies to New England by the famous clipper ships that sailed around the Atlantic Ocean.

FIG. 46. Gathering sugar-cane stalks for the refinery

Where sugar cane grows best. To see the sugar cane growing in the United States today we must go to the swampy southlands of Louisiana and Texas. There the soils are rich, the growing season unusually long, — from seven to nine months, — and the rainfall bountiful. Explain this rainfall. Wherever these lands are too wet the water is pumped into reservoirs and used to water the lands if there is a shortage of rainfall during the growing season.

From cane to sugar. Early in the fall the soil is made fine and plowed into trenches. Instead of planting seeds, as with the grains, the cane stalks are laid lengthwise in the furrows. At each joint of the long stalks there is a

bud, or eye, like the eye of a potato, which, when planted, sprouts and reproduces the cane stalk. Seven to nine months later, when the leaves begin to turn yellow and drop, the thick stalks are cut by hand. At this time it is a common sight to see children sucking pieces of the juicy cane stalk. When cut, the heavy cane is carried



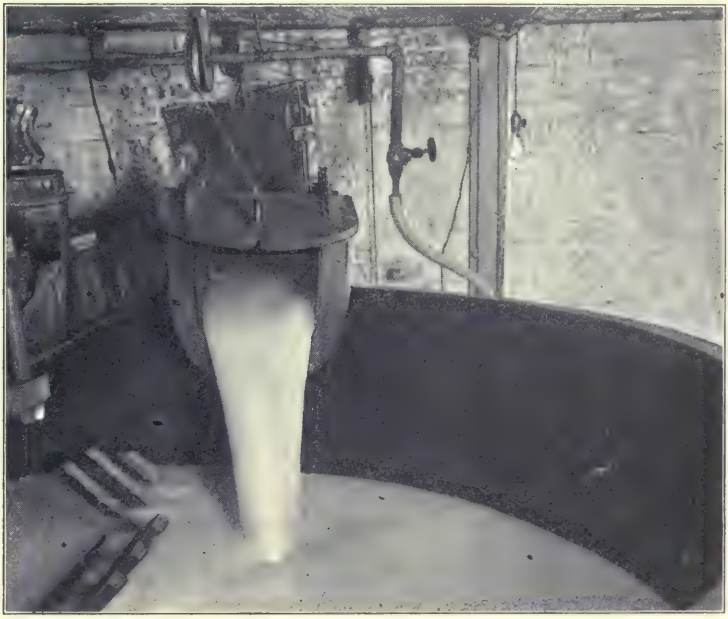
From "The World's Commercial Products"

FIG. 47. Feeding sugar cane into the crusher

by local railroad trains into near-by sugar mills. There the canes pass between rollers, which press the juice from the stalks. At first the juice is so dark and discolored that it must be purified and filtered. It is then boiled in copper vats until it becomes a thick, brown sirup, which is a mixture of molasses and sugar. This material is revolved at a high speed in cylinders with sievelike walls through which the liquid molasses oozes. As a result a coating of crystallized sugar is left on the walls of the cylinders. When recrystallized, it is white.

BEET SUGAR

France and the sugar beet. Sugar cane was long our chief source of sugar. When the great wars of Napoleon were being carried on, France was cut off from the cane-sugar supply of the West Indies. Thus she was forced



© American Sugar Refining Co.

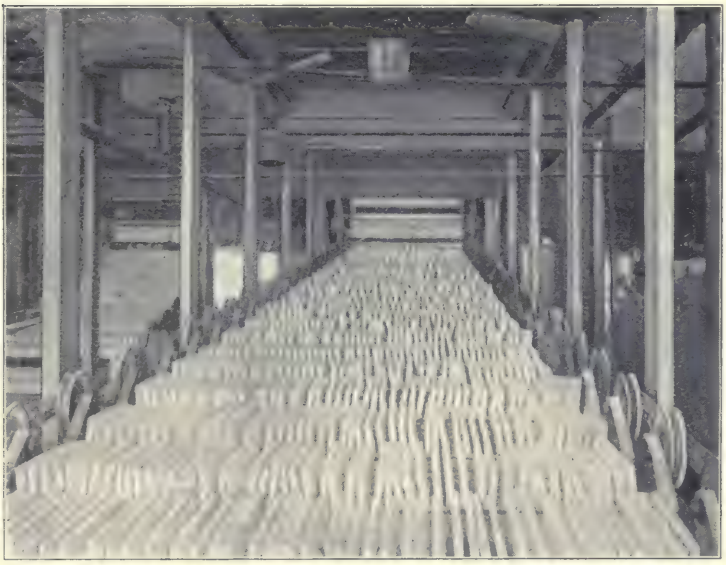
FIG. 48. Sugar after leaving the vacuum pan

to seek other sources for sugar. Then it was that Napoleon Bonaparte set the scientific men to work to find which of all the fruits and vegetables would yield the most sugar. As a result the beet was chosen, and it has been improved until we have the sugar beet of to-day.

The sugar of middle latitudes. The sugar beet, which is longer and paler in color than our red garden beet,

© American Sugar Refining Co.

FIG. 49. Sugar crystallizing in molds, sugar refinery, Jersey City



© American Sugar Refining Co.

FIG. 50. Sugar on moving drying pans

thrives in the north intermediate zone and can be successfully raised over a broad area of the United States. This

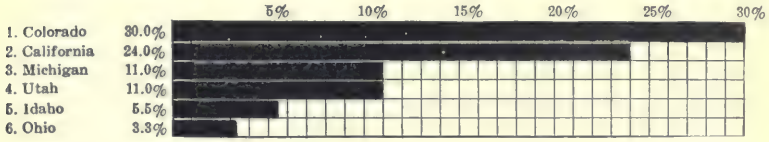


FIG. 51. Leading states in beet-sugar production

area is a belt two hundred miles wide, which extends from Delaware to Massachusetts and then continues

FIG. 52. Thinning sugar beets by hand

across the United States, taking in southern New England, parts of New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa, Minnesota, Nebraska, and North and South Dakota, and extends westward to

the Rocky Mountains. Here the belt turns southward and sweeps over a great part of Colorado, New Mexico, and Arizona, beyond which it widens and extends northward, including all of California and most of Utah, Nevada, Idaho, Washington, and Oregon. Beets may be grown

FIG. 53. Carting sugar beets to the factory

elsewhere in the United States, but within this area, with proper care, we get a valuable and profitable crop. We are producing several hundred million pounds each year. Find on the sugar map the areas where sugar beets are now produced. By comparing these areas with the region where they *can* be produced, you will see how great are the possibilities for a future increase in our yield (Fig. 44).

Growing beets for sugar. The planting of the sugar beet is no longer laborious, as it has been made easy by

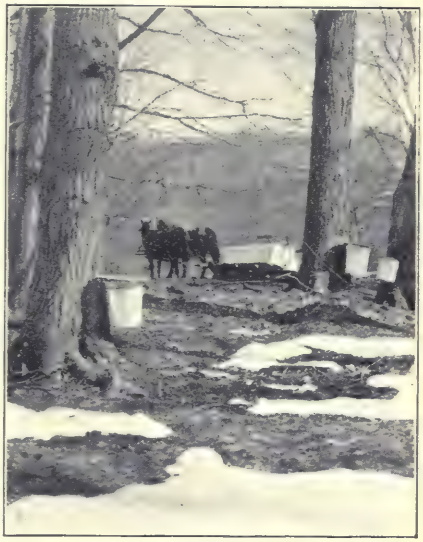
the use of machinery. When the young plants come up much hand labor is needed, for they must be thinned and weeded to give the more vigorous plants a chance to grow. Several months later the ripe beets are ready for the factory. They are so perishable that factories are built near enough to make possible the carting of the beets to market. Once the beets reach the factory they are cut into long, slender pieces and put into vats of boiling water which dissolves the sugar. As in the making of cane sugar, this liquid is boiled down and the molasses separated from the sugar. This beet sugar is exactly as good as cane sugar, and there is no difference in the taste of the two. The amount of beet sugar produced in the world is about three fourths as great as the amount of cane sugar produced.

Other uses. The tops and leaves of the beets are fed to cattle or are plowed under to fertilize the land. The beet pulp left after the sugar has been soaked out is a valuable feed for cattle and is therefore stored in silos. Its value is one fifth to one third as much as that of the beets.

MAPLE SUGAR

The people of New England, New York, Pennsylvania, and Ohio know that the sap of the (rock or red) maple tree begins to run early in the spring when the days are warm and sunny and the nights sharp and frosty. At this time short metal tubes are inserted into the trees. Through these tubes the sap drips into buckets covered to keep out dirt and rain. The sap is collected and transported to the "sugar house," where it enters a long shallow pan heated by a roaring wood fire. The pan is divided by partitions into many channels, and as

the sap flows in a winding path from one to another, the water in the sap is evaporated and the remaining sirup becomes thicker and thicker. By the time it reaches the end of the pan it has become maple sirup. If the boiling is continued and the sirup stirred and cooled, it becomes maple sugar. An especially delicious candy is made by cooling the thickened sirup on snow.



Courtesy of S. E. Lawton, M.D.

FIG. 54. Gathering the sap of the maple tree, Brattleboro, Vermont,

HONEY

Another kind of sweetening is derived from the myriads of honeybees which take the nectar from the flowers of the sweet clover, buckwheat, and many other plants. The honeybees make wax honeycombs and then fill them with the delicious pure liquid known as honey. Many farmers keep bees and sell both the honey and the wax. Beeswax is the purest wax and makes the finest candles. More and more the farmers on the high irrigated areas of Colorado, Utah, and Idaho are housing honeybees in the alfalfa fields, where they produce an abundance of beautiful white honey. In southern California, New Mexico, and Arizona alfalfa is a source of amber honey of a different flavor. The choicest honey is produced from the white clover of the Northeastern states.

FIG. 55. Raising bees in a clover field

FIG. 56. A Michigan apple orchard fragrant with blossoms

Thus the farmer reaps from his fields not only clover and alfalfa hay but also wax and honey. This is another way by which, with little added cost, our supply of sweets may be increased to meet the growing demand.

Fig. 57. Delaware grapes

FRUITS

Problem. *How to supply fresh fruits the world over at any season.*

Value of our fruit crop. The fruit crop of the United States is four times as valuable as all the gold and silver which this country mines. The fruit-growing industry has become important in many widely scattered regions — from the apple orchards of the Hood River Valley to the orange groves of Florida and from the Great Lakes vineyards to the raisin fields of California.

OUR FRUIT LANDS

The apple, chief of all the fruits, is common to our more northern lands. Oranges, lemons, and grapefruit can thrive only in the nearly frost-free regions of the South and Southwest. Grapes too are suited to the warm

FIG. 58. Packing peaches at Fort Valley, Georgia

Southlands, but they flourish also on sunny slopes near the shores of the Great Lakes, where the warm waters of the lakes near by prevent early autumn frosts and give the fruit time to ripen. In North Carolina and South Carolina also grapes ripen in the valleys and on the mountain slopes, often to elevations as high as 1500 feet above the sea.

Peaches, which are more sensitive than apples to frost, grow most successfully on the hill slopes of the Ozarks

and in Georgia and Alabama. Of all the Southern states Georgia leads both in the quality and quantity of peaches produced. It is surpassed only by California, which produces twice as many.

Enlarging fruit lands. New fruit and berry lands of wide extent have been made possible by the irrigation

© James McCulloch, Phœnix, Arizona

Fig. 59. Date-bearing palms, Arizona. Products of irrigation

of the dry lands of the West and by the draining of swamp lands. The desert lands which were once covered with sagebrush are now fragrant with the blossoms of rows and rows of peach, pear, and apple trees. The fruits of these irrigated lands — from the apples of the Yakima Valley of Washington to the dates of Arizona — are prized for their perfection and delicious quality. Explain the fruit-growing areas (Fig. 80).

PROTECTION AGAINST FROST

Killing frosts. In the fruit-growing regions throughout the country frosts are often so destructive as to amount to calamity to these areas. In the more northern regions the orchards can live through the cold winter, but the crop of one season is ruined if the frosts come before the fruit ripens, and often the trees themselves are killed if severe cold comes too early. In the orange groves of Florida and California and in many of the irrigated lands of the Southwest frost at any season is disastrous, for in these warm lands the fruit is ripening in every month of the year.

© Walter Lubken, Boise, Idaho

FIG. 60. Picking peaches on the irrigated lands of the Boise Project, Idaho

In 1906, early in October, a temperature thirteen degrees below freezing killed hundreds of thousands of peach trees in western Michigan. In 1913 the first widespread frost for forty years was felt in southern California, doing severe damage.

Fruit protection. Every possible way of preventing frost is being tried in the citrous-fruit regions. We have all covered the flowers in our gardens or outside window

boxes with cloth or paper to keep them warm when frost is expected. The great fruit groves cannot be so easily covered. When the United States Weather Bureau sends out warnings that frost is likely to occur during the night, coverings are quickly spread over frameworks of slats which have previously been made ready or smudge

FIG. 61. Orange trees laden with fruit

fires are lighted to make a thick, screenlike cover of smoke over the orchard. A cloud is sometimes formed above the trees by spraying fine mist into the air. This cloud serves as a blanket, which prevents the escape of the heat that the earth has gathered during the day and so helps keep the temperature above the frost point. Some orchards have steam pipes running through them, so that when a frost is coming the heat can be turned on just as it is in our houses. On irrigated lands plants are often protected from frost by flooding the fields.

FRUIT TRANSPORTATION

Fresh fruits at all seasons. Most fruits spoil so quickly that great care must be taken in the transportation and marketing of them. Before the days of railroads and refrigerator cars strawberries and peaches could be had only

© H. C. Mann

FIG. 62. Shipping strawberries North by refrigerator cars, Norfolk, Virginia

during the few weeks of the ripening season, and nowhere except in immediate localities where they were grown. To-day the people in New York and all our Northern cities can eat peaches from California, and Florida strawberries can be had in midwinter. This has been made possible by the invention of refrigerator cars, which deliver the fruits at far-away markets as fresh as when they were packed. Thus at added cost fresh fruits can be had at any season, even far from the producing regions.

CANNING AND DRYING FRUITS

Preserved fruits. The canning and drying of fruits also have made it possible for us to enjoy them out of season and far from where they are grown. The thrifty housewife is busy much of the summer canning and drying

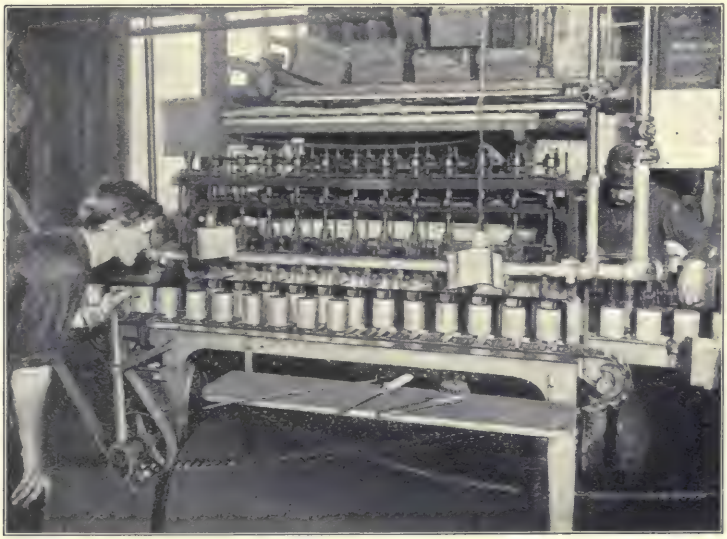


FIG. 63. Soldering tops on cans of corn, Illinois

fruits. berries, and vegetables to provide food for the family in winter. In much the same way this is now being done on a large scale in factories built in the fruit-growing regions. The canning and drying industries have grown rapidly owing to the great demand for fruits at all seasons.

Fruit-canning in California. More fruit and vegetables are canned and dried in California than in any other state. California supplies almost all the canned apricots,

many of the peaches, and a large part of the canned tomatoes, asparagus, peas, and beans. This is partly because the mild winter temperatures of the Pacific coast (see Fig. 37) have made this state a leading fruit-grower and an important vegetable-producing region. California raises such large supplies of these products that they cannot all be consumed by the people of the Pacific states. If the fruit and vegetable crops in the East are short, and prices therefore high, California can supply the need by shipping her products fresh to Eastern markets. But if there is no shortage California producers cannot afford to send their products so long a distance in refrigerator cars to be sold at the low prices which prevail. The surplus produce must therefore be canned or dried to preserve it.

Fruit-drying. The dry atmosphere and almost constant summer sunshine of southern California are particularly favorable for the drying industry. In the earlier days of the United States almost every household dried its own supply of apples, peaches, and apricots for winter use. California is so well suited for drying fruits that it is less expensive to dry them there and ship them across country or even around Cape Horn to our Atlantic coast than it is to dry them in the more humid regions of the East. The drying of raisins and prunes has become so large an industry in California that some American prunes are found even in the markets of Europe, which long supplied us with them, and California raisins have almost replaced in this country the raisins of Spain.

Fruit exports. Even the most delicate of our fruits can be shipped canned not only to all parts of our country but abroad. We export about $35,000,000 worth of fruit each year — more than any other country.

NUTS AS FOOD

Closely associated with the fruit orchards are the English walnut groves of California, which yield a very profitable crop. Throughout the Southlands, from Texas to Florida, pecans are grown abundantly, and large crops of peanuts are produced on the sandy soils of this southern coastal plain. In the drought district of Texas peanuts thrive where nothing else will grow. Peanuts are a most excellent food and a good substitute for butter, cheese, and meat. As it becomes more and more difficult to get animal products we can depend more largely upon the oil and protein which peanuts supply.

As our population becomes larger and our need for food greater, we can follow the custom of the American Indians by using as a substitute for wheat the meat of the acorn, which combines the fat of meats with the starch of grains. When the acorn meat is dried and ground fine it makes a good meal except for its bitter taste, which may be removed by washing. If mixed with corn or wheat flour it makes an excellent bread. We have in acorns a natural food which is produced without cultivation and which may be used as it has long been used by primitive peoples of many countries.

VEGETABLES

Problem. *How centers of vegetable production shift with changing seasons.*

Value of the home garden. Outside of our large cities almost every house has a garden plot or window box where vegetables are grown for the home table. Many farmers raise sufficient quantities of vegetables to supply

their own needs and an added amount to sell in the near-by markets. The potato, which is the most common food next to bread, is grown from Alaska to Florida. Since vegetables supply at least one fourth of our daily food, it is the duty of everyone to help grow as many as

Courtesy of S. E. Lawton, M. D.

FIG. 64. Garden vegetables, Brattleboro, Vermont

local conditions will permit. Thus we can do our part toward increasing the food supply of the United States.

Roots, stems, and leaves as food. The food value of some vegetables is in the roots; of some, in the underground stems or tubers; and of others, in the leaves, the stems, or the fruits. In eating turnips, parsnips, and beets we enjoy the roots of the vegetables. The onion is the bulb of the plant. The food value of the potato is in the underground stem, or tuber. Of cabbage, lettuce, and spinach it is the leaves which we eat. Peas and beans

represent food from seeds, and tomatoes, cucumbers, and melons are the fruits of the vegetable kingdom. What roots, stems, and leaves do you eat?

Vegetables out of season. To-day the people of the cities and towns want fresh vegetables as well as fruits the year round. Some of these are supplied out of season from hothouses near by. Others are brought by fast

Courtesy of Duluth Commercial Club

FIG. 65. Packing lettuce for market

freight or refrigerator cars and ships from the winter gardens of the South. The Atlantic coastal plain has become the chief center of the trucking industry for supplying vegetables to city markets. This is because there are many large cities along our eastern coast to be supplied and because the sandy soils and moist, mild climate of this plain are suited for the growth of these vegetables. During the summer and early fall it is the truck farms of New Jersey, Delaware, Maryland, and Virginia that supply the Northern markets with all kinds of summer vegetables and fruits: potatoes, cabbages,

tomatoes, peas, beans, asparagus, strawberries, melons, and many others. The three great centers of truck-farming in this northern section of the plain are southern New Jersey, the peninsula between Delaware Bay and Chesapeake Bay, and the region around Norfolk, Virginia. These areas all have water on at least two sides, which gives the mild, moist climate needed for truck-farming.

As late fall approaches, with the cold, frosty nights which kill these plants, the source of truck supplies moves southward, and the farms and gardens of North Carolina, South Carolina, Georgia, and Florida produce for the Northern market.

As midwinter approaches, the Gulf states and Florida take their turn in supplying the Northern demand. The two principal Gulf centers are in the rich river lands of southern Louisiana and in southern Texas along the valley of the Rio Grande. Early potatoes, onions, and strawberries are the big crops here, but these, like the other truck regions, produce all vegetables and fruits in large quantities. There are centers of lesser importance in southern Alabama around Mobile and in southern Mississippi.

West of the Rocky Mountains the irrigated lands of California and the Southwest provide the winter vegetables for the Northern cities.

SOIL PRODUCTS CONSERVED BY PROTECTION FROM INSECT PESTS

Everyone who has grown vegetables has found that to make the crop a success one has to fight constantly not only weeds but the many insect pests which live in the garden. There are many which, like the common potato beetle or cabbage worm, eat leaves and stems; some, such

as the cutworm, live by gnawing off at ground level the stems of plants; still others bore into the fruits. Not only are our gardens in danger but our farm crops, our fruit trees, and our forests are enormously damaged by insect pests. Each year a part of the United States crop-yield worth more than a billion dollars is destroyed by insects.

One of the ways to lessen this damage is by practicing crop rotation. If the wheat crop of one year is injured by some insect which lives only upon wheat, the pest may be driven from the region by planting other crops the following year. Fruit trees and some garden crops can be best protected by spraying the trees and plants with poison which kills the insect. This method is used in fighting the gypsy and browntail moths, which are doing much damage to the trees of New England.

Fig. 66. Cotton-boll weevil, a serious pest to the cotton crop. Enlarged five times. (After Hunter & Pierce)

Birds the friend of the farmer. But spraying is too expensive a method to be used in saving the crops of our miles of farms and the trees of our vast forests from the ravages of insects. We have a natural protection in the birds, many of which live upon insects and destroy them by millions; they also help enormously by eating seeds of weeds. Bluebirds eat beetles, caterpillars, grasshoppers, and spiders; the swallow destroys many ants, beetles, flies, and weevils. Tons of weed seeds are eaten by sparrows. Even the crow, though he eats some corn, kills so many insects that he does more good than

harm, and hawks help far more by eating insects than they harm by catching chickens. But so many of our birds have been killed that their numbers have decreased rapidly. In 1910 there were probably not more than half as many birds in the United States as there had been fifteen years before. As our birds become fewer, insects and weeds spread and increase in numbers, and the damage to our crops grows greater. We must use every means to protect our bird life. In this work boys and girls can help. You can invite birds to live around your home and protect your trees and gardens from insects by placing bird houses in your trees for the birds to live in. And you can help much by never killing birds nor robbing birds' nests.

How to prevent insect pests from entering the United States. Many of the insect pests have been brought to this country from Europe upon trees and other plants which have been imported. Great care must be taken in the future to inspect carefully all imported plant stock to see that no new pests are allowed to enter. This inspection should be at the ports at which the plants enter the United States and should be enforced by law.

ANIMAL PRODUCTS

Problem. *How to supply meat for the growing population.*

Meat as food. Millions of people in China, Japan, and India live entirely upon plant food, rarely, if ever, eating meat. In the cold North, where agriculture is impossible, the Eskimos hunt wild animals for their food supply. In most lands people eat both vegetables and meats.

FIG. 67. Silo and dairy herd

Courtesy of F. W. Rane

FIG. 68. Pigs in clover

BEEF; CATTLE-RAISING

Value of cattle. Our meat is the flesh of cattle, hogs, and sheep. The raising of these animals has increased until almost every farm in the United States rears some or all of them. The value of the cattle and cattle products is greater than that of hogs and sheep together.

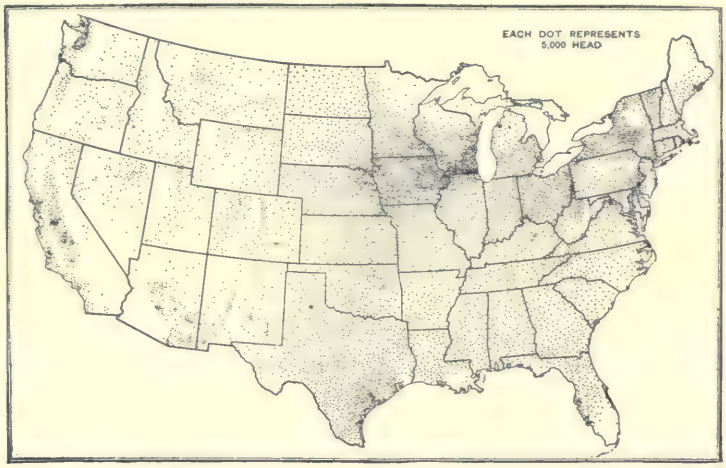


FIG. 69. Distribution of cattle in the United States

There are several times as many cattle in the United States as there are families — about 65,000,000 cattle.

The Western ranch. Millions of cattle may be found grazing on the great Western plains and prairies (relief map). In this dry country the growth of grass is scanty (Fig. 9). To feed the thousands of cattle which each ranchman owns, the ranch must be miles in extent. There are ranches in Texas as large as the state of Connecticut — so large that the ranchman must ride his horse for days to cross from one side of his land to the other. The only

means of communication with neighboring ranchmen is by telephoning over wires run along the fences.

The free range. There is much unfenced land in the West, owned by the United States government, which is free for the use of stockmen. On any part of this land any person may let any number or any kind of stock graze freely at any time. This is known as the free range. The most desirable part of this land is that along the widely separated streams where there is water for

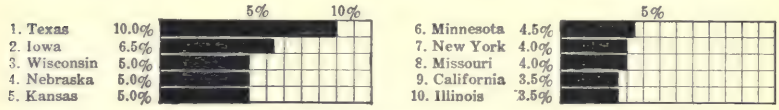


FIG. 70. Leading states in cattle-raising

the cattle and where there are trees to supply wood for the ranchman's house.

Since the cattle of many ranchmen graze together on the range, each owner must mark, or brand, his stock, that he may know his own from those of other ranchmen. Such a brand is burned with a hot iron into the hide of each animal, after which the cattle are turned loose on the range.

The round-up. Each spring the calves of the range cattle must be branded. To do this it is necessary for the cowboys of many ranchmen to ride into the range and drive together the cattle, which have often wandered more than a hundred miles from the ranch houses during the winter. A group of eighteen or more cowboys rides in one direction, and other squads in other directions, until they have surrounded the widely scattered cattle. They then drive the cattle toward the center of the circle until all have been brought together. This is known as the

round-up. Each ranchman can then select his own cattle by the brand, and since the calves follow their mothers, it is easy to tell to which owner they belong and to burn the right brand upon them.

Again, in the fall, there is a round-up for the purpose of selecting the cattle which are to be fattened for market.

© Underwood & Underwood

FIG. 71. Cowboys rounding up cattle, Arizona

Use and waste of the range. So many cattle have been allowed to graze on these free lands that to-day in some places all the grass has been killed; in others it is so sparse that sixty or sixty-five acres of land will feed only one animal. The area of this public land is also steadily growing smaller. Much of it is now being irrigated for homesteads. Therefore there are now few cattle on the free range; most of them are on private ranches.

Fattening cattle. These grass-fed cattle are lean and are now shipped eastward to the corn belt to be fattened. Here they are kept from three to nine months, and are so fed that they gain in weight from one to two and one-half pounds each day. It takes more than ten pounds of

FIG. 72. Meat in packing-house

corn to make one pound of beef. This explains why meat is more costly than grain and why the people of many lands cannot afford to eat it.

Packing centers. Once the cattle are fattened great numbers are shipped to the stockyards of Omaha, Kansas City, Fort Worth, or Chicago, where they are slaughtered for beef. Chicago has grown to be the largest cattle market and the chief meat-packing center of the world because of its nearness to the corn belt and its importance

as a railroad center. The preparation of the meat is carefully inspected by the United States Department of Agriculture, and when found satisfactory it is stamped and is then ready for the market.

Conserving all the animal. The modern packing industry is an excellent example of the prevention of waste. Every part of the animal is used. The hides are made into leather, the fats into tallow candles and soap, the hoofs into gelatin, and the bones and blood into fertilizers.

Drying, salting, and smoking. The meat which is to be eaten fresh is stored in ice houses until refrigerator cars are ready to carry it to market. That which is to be kept a long time is dried, salted, and smoked. Smoked meats are all soaked in brine for two or three days and then smoked over a fire of green hickory or maple wood. Many farmers have small smokehouses in which they cure their hams, but in the great meat factories this is done on a large scale.

DAIRY PRODUCTS

The raising of cattle has become the chief industry of our great Western plains, not because this is the best place in the United States to raise cattle but because they can be raised here on lands which are too dry to be used for agriculture unless irrigated. Cattle, however, thrive better on the thick grass of the well-watered pastures farther east, and there are far more cattle in the corn belt than on the Western grasslands.

Dairy cattle. The cattle which range our Western plains are used only for beef, but in the Northeastern states the keeping of cattle for dairy products is an important industry. Cattle fed on the moist grass, the winter silage, and the grains of this region yield an

abundant supply of milk. The cool climate of the more northern states makes the handling of milk easy, and the many large cities close by furnish a ready market for the butter, milk, and cheese.

Leading dairy states. New York leads all the other states in the production of dairy products, Wisconsin

Courtesy of the state of Washington

FIG. 73. A modern dairy farm

being second, and Pennsylvania third. New York is far ahead in the value of milk sold, while Wisconsin surpasses New York in the production of butter and cheese. New York dairy farms sell their product in the form of milk, as many large cities where there is a great demand for milk are so near at hand that it can be readily transported to them. The Wisconsin producers make much of the milk into butter and cheese, because when

the industry began their farms were farther away from the great consuming markets. Butter and cheese can be transported much greater distances than milk without spoiling, and so may be shipped to distant markets.

Value of dairy products. Milk is a more economical food than either meat or eggs. There is no more widely

Courtesy of the state of Washington

FIG. 74. Sheep on the Ranch

used food in the world than milk or its products. One pound of cheese gives in food value more than twice as much energy as one pound of fowl or round steak and almost twice as much protein as the same amount of fowl or ham. Cheese, therefore, is a cheaper food than meat.

LAMB AND MUTTON; SHEEP-RAISING

Sheep on the range. Sheep are raised either for their wool, which provides us with woolen clothing, or for the lamb and mutton which we have upon our tables. Great

flocks of sheep may be seen grazing on the poorer lands of the free Western range. Sheep can live with less water and less grass than cattle. They can climb easily over

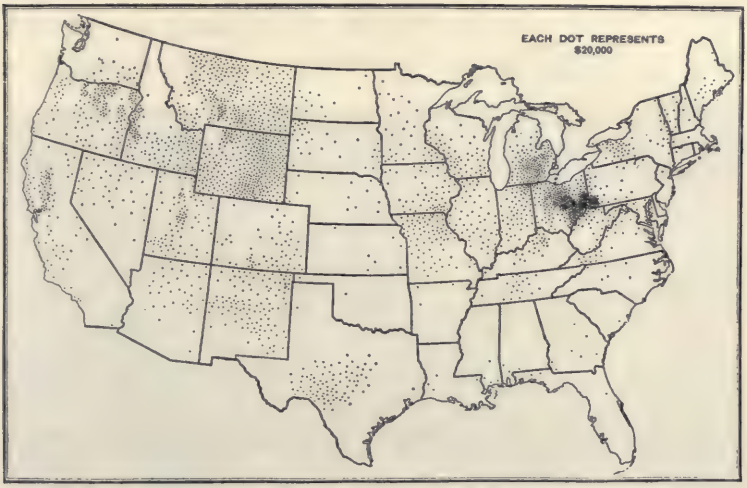


FIG. 75. Value of wool produced in the United States in 1909

rough mountain slopes, and with their long, sharp noses they can reach the grass which grows in the narrow cracks between the rocks. Their heavy coats of wool

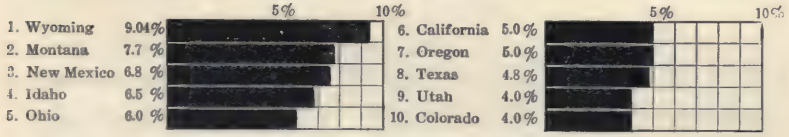


FIG. 76. Rank of states in sheep-raising

keep them warm in colder lands than those where cattle thrive. Therefore the cattle industry has crowded the sheep out upon the colder, rougher, and drier parts of our Western grazing lands. Compare on the product

map (Fig. 80) the position of the Western sheep-producing areas with the location of the beef-cattle belt. Explain why it lies farther north and west.

Many of the sheep which have grazed during the summer on the mountain slopes of the range are fed during the cold winter on the alfalfa and grain fields of the

FIG. 77. A pig-club boy

plains below, which the shepherd leases from the farmer. In summer the shepherd takes his flock again to the hillside to graze. Care must be taken that the sheep do not crop the grass so closely that the soil will be washed by the rain from the hillsides and laid down upon the alfalfa fields below, destroying the crops.

Sheep on pastures. On the farms of our Northeastern states, from Michigan to the Atlantic, small flocks of

sheep are cared for and are fed on corn, oats, and clover. The pastures are fenced to protect the sheep from dogs, and shelters are provided for use in cold weather.

PORK; HOG-RAISING

Hogs and the corn belt. Hogs, unlike sheep and cattle, do not generally live on grass. They are raised in

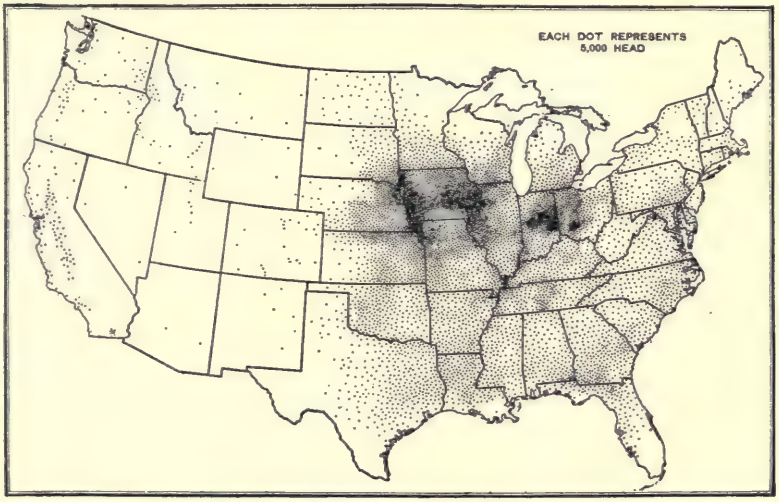


FIG. 78. Distribution of swine in the United States

corn-growing lands. About one third of all the hogs in the world are grown in the United States corn belt (see Figs. 40 and 78). The fattened animals, of which the Berkshire is the best type, are used for lard and pork and the lean ones for bacon. More than half of all the meat produced in the United States is pork. It is the chief meat of the laboring man.

Children are helping the government. Children can help much in taking care of young animals. Many clubs

have been formed to encourage boys and girls to raise lambs, calves, and pigs. In many localities bankers who have realized the value of pig clubs in increasing the supply of meat and in teaching members good business methods have assisted the children. The banker buys a pig for the child, and after young pigs are raised the boy or girl returns two of these to the banker to pay for the one given. These two the banker in turn lends

FIG. 79. Rank of states in hog-raising

to other children, thus carrying on an endless chain. In 1918 there were thousands of these clubs helping the government by raising pigs.

Our export trade. Live cattle, beef, pork, and mutton are being sent almost daily to Europe. We send a larger quantity to England than to any other country. The proportion of lamb and mutton going into the export trade of the United States is much less than that of beef. Using your commerce map (Fig. 169), trace the route by which cattle and sheep are sent from our Western ranches to Europe.

POULTRY AND EGGS

When our forefathers first came to this country they found roaming in the New England forests wild turkeys which long supplied game for their tables. Of all our farm animals the turkey is the only one which lived in America before the colonists came. Most of the wild turkeys have now been killed, but many are raised on

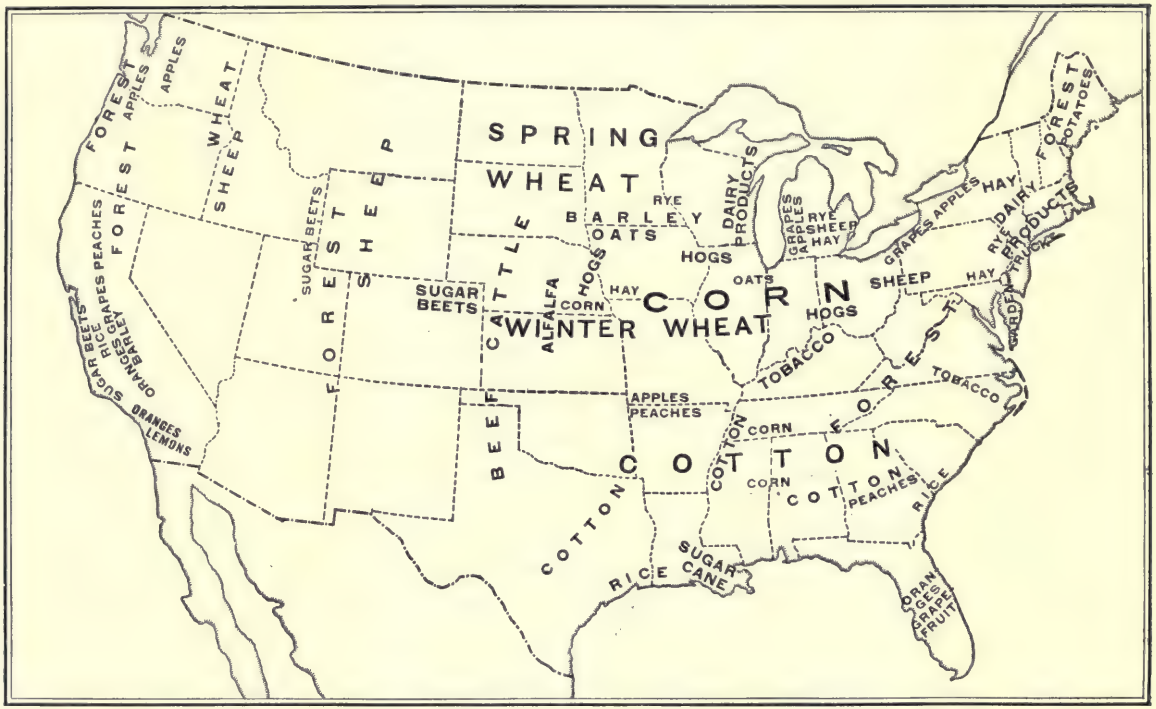


FIG. 80. Product map, showing areas most important for different farm products

our farms to-day, and every child still looks forward to the turkey gobbler of the Thanksgiving dinner.

Raising fowls for their meat and eggs has become a great industry. To yield the best returns they must be fed and cared for as carefully as other animals. Good

Courtesy of the state of Washington

FIG. 81. A modern duck farm in the state of Washington

farmers no longer allow their chickens, ducks, and geese to feed merely upon refuse, but make their raising as important a part of the farm enterprise as the rearing of sheep or hogs.

The poultry and eggs produced yearly in the United States have a value about as great as our wheat crop, and the eggs produced each year are several times as valuable as our annual yield of gold and silver.

127
122
117
112
107
102 Longitude
45
40
35
30
25
Str. of Juan de Fuca
Vancouver
C. Flattery
WASHINGTON
Olympia
Seattle
Tacoma
Spokane
Astoria
Portland
Mt. Rainier
Columbia R.
Mt. Hood
OREGON
Salem
Eugene
Mt. Shasta
Klamath L.
Medford
Sacramento
Oakland
San Francisco
San Jose
Pt. Concepción
Santa Barbara
Los Angeles
Pasadena
San Diego
SANTA BARBARA IS.
CALIFORNIA
Reno
CARSON CITY
MT. WHITNEY
Tulare L.
GREAT BASIN
Boise
Snake R.
Pocatello
Great Salt L.
SALT LAKE CITY
Ogden
Green R.
UTAH
GRAND CANYON
ARIZONA
PHŒNIX
Gila R.
Tucson
Bisbee
Gulf of California
LOWER CALIFORNIA
PACIFIC OCEAN
MEXICO
Missouri R.
Great Falls
MONTANA
HELENA
Yellowstone R.
YELLOWSTONE NAT'L PARK
Rocky Mts.
WYOMING
Laramie
CHEYENNE
Platte R.
DENVER
Colorado Springs
Pikes Peak
Pueblo
COLORADO
Arkansas R.
SANTA FÉ
Albuquerque
Canadian R.
NEW MEXICO
Llano Estacado or Staked Plain
Roswell
El Paso
Rio Grande
Pecos
TEXAS
Red R.
Fort Worth
Colorado R.
Brazos
AUSTIN
San Antonio
Rio Grande
Regina
Winnipeg
Grand Forks
NORTH DAKOTA
BISMARCK
Aberdeen
SOUTH DAKOTA
PIERRE
Sioux Falls
Black Hills
NEBRASKA
Grand Island
Platte R.
LINCOLN
Beatrice
Kansas R.
TOPEKA
KANSAS
Wichita
OKLAHOMA
Canadian R.
Red R.
ARCTIC OCEAN
GREENLAND
Baffin B.
DOMINION OF CANADA
The Great Lakes
UNITED STATES
Mississippi R.
Gulf of Mexico
WEST INDIES
Caribbean Sea
CENTRAL AMERICA
SOUTH AMERICA
ATLANTIC OCEAN
PACIFIC OCEAN
170
160
150
140
ARCTIC OCEAN
Pt. Barrow
WRANGELL I.
C. Lisburne
ARCTIC CIRCLE
Yukon R.
Fairbanks
Prince of Wales I.
Nome
St. Lawrence I.
Norton Sd.
Mt. McKinley
Mt. Logan
C. Romanzof
NUNIVAK I.
BERING SEA
PRIBILOF IS.
Bristol B.
ALEUTIAN ISLANDS
KODIAK I.
Mt. St. Elias
Juneau
Sitka
Chichagof
Baranof I.
ALASKA
SCALE OF MILES
0 100 200 300 400 500
50
60
117
112
107
Longitude
102
West
97

West 92 from 87 Greenwich 82 77 72 67
CANADA
ATLANTIC OCEAN
GULF OF MEXICO
L. of the Woods
L. SUPERIOR
MICHIGAN
L. HURON
L. ONTARIO
ERIE
OTTAWA
Montreal
Quebec
St. John R.
Fredericton
NOVA SCOTIA
MAINE
Portland
CONCORD
BOSTON
C. Cod
VERMONT
NEW HAMPSHIRE
MASS.
CONN.
ALBANY
Burlington
Syracuse
Rochester
Buffalo
Niagara Falls
Toronto
Detroit
Cleveland
Saginaw
Grand Rapids
Lansing
Duluth
St. Paul
La Crosse
Madison
Racine
Rockford
Chicago
Dubuque
Davenport
DES MOINES
IOWA
Quincy
Peoria
Springfield
Indianapolis
Terre Haute
Fort Wayne
Toledo
Columbus
Wheeling
Cincinnati
Dayton
St. Joseph
Kansas City
St. Louis
Jefferson City
Evansville
Louisville
Frankfort
Lexington
Charleston
Virginia
Washington
Annapolis
Richmond
Norfolk
Nashville
Knoxville
Memphis
Chattanooga
Sparta
Charlotte
Raleigh
C. Hatteras
Wilmington
Columbia
Fayetteville
Arkansas R.
Fort Smith
Little Rock
Birmingham
Atlanta
Augusta
Macon
Charleston
Savannah
Montgomery
Meridian
Vicksburg
Jackson
Shreveport
Red R.
Baton Rouge
Mobile
Jacksonville
Tallahassee
St. Augustine
Pensacola
New Orleans
Galveston
Delta of Mississippi R.
Tampa
Lake Okeechobee
C. Canaveral
C. Sable
Key West
Florida
Pittsburgh
Harrisburg
Trenton
Philadelphia
Wilmington
Dover
Baltimore
Washington
Richmond
C. Charles
C. Henry
Norfolk
Atlantic City
Camden
Newark
New York
Brooklyn
Jersey City
Hartford
New Haven
Providence
Newport
Long I.
Block I.
Martha's Vineyard
Nantucket I.
Worcester
Springfield
Lowell
Portsmouth
Manchester
Concord
Lewiston
Bangor
Augusta
Portland
C. Ann
C. Cod
Montpelier
Burlington
Dominion of Canada
UNITED STATES
SCALE OF MILES
0 50 100 200 300 400 500 600
NEW ENGLAND
AND COAST OF
MIDDLE ATLANTIC STATES
(on enlarged scale)
SCALE OF MILES
0 25 50 100 150 200
from 92 Greenwich 87
74 72 70
38 40 42 45

CHAPTER IV

FOOD — WATERS AS A SOURCE

FISHERIES

Problem. *How we may use and protect our fish.*

Fishing is a common pastime wherever there are ponds, lakes, creeks, rivers, or bays. For many people it is a business, and it has become a well-established industry, since fish form a very important part of our food supply.

Fish as food. Our forefathers on the Atlantic coast would have found it very hard to get food enough for the long, cold winters had it not been for the fish which they could catch off the New England shores. The cold, salt waters of the northern Atlantic swarmed with cod, haddock, halibut, and mackerel, which could be had for the catching. By far the most important to the colonists was the codfish, which they salted and smoked in great quantities and preserved for use through the winter. From that day to this, fish have been an important part of the food supply of the United States, and fishing is still one of the most important industries along the Atlantic, Gulf, and Pacific coasts.

FISH OF THE ATLANTIC

Warm-water and cold-water fish. The more important fisheries on the Atlantic coast are north of Cape Hatteras, because the most valuable food fish live in cold

waters. The waters south of Cape Hatteras are warmed by the Gulf Stream. There are some fish, such as bluefish and mackerel of various kinds, also the shellfish (clams and oysters), that live in either cold or warm waters, but they are not of such value to the United States as the cold-water fish. There are also important fisheries all

© Detroit Publishing Co.

FIG. 82. Unloading codfish at Gloucester

along the southern Atlantic and Gulf coasts, where the mullet and red snapper are the chief species.

Deep-water fishing. Open-sea fishing off the New England coast employs hundreds of brave men, who go out in their fishing boats at all seasons of the year and in all kinds of weather. The cod, halibut, and haddock are caught in trawls, — great nets which are drawn along the sea bottom by boats known as trawlers. Some kinds of fish, such as mackerel, which swim in large swarms called schools, are caught in drift nets, or seines. These nets

are let down into the water in such a way that the schools of fish can swim into them. Then, just at the right moment, they are tightened up so that the fish cannot escape and are hauled on board the boat.

© Underwood & Underwood

FIG. 83. Seining salmon on the Columbia River

A still more exciting method of fishing is by the use of the harpoon, a long, sharp-pointed spear with a barbed tip and a long rope attached to the handle. The fisherman throws the harpoon in such a way as to spear the fish. The barb catches in the flesh, and the fish is pulled aboard by means of the rope. This method is used most in catching swordfish.

FISH OF THE GREAT LAKES

The open-ocean waters are not the only places where fish are caught. The Great Lakes, which are really extensive inland seas, also have large fish, which make excellent food and so are caught in great quantities. The best of them are the lake salmon, lake trout, and bass, which are eaten very generally in the Lake region and throughout other sections of the Middle West.

PACIFIC-COAST FISH

Salmon. On the Pacific coast the open-sea fishing is not so important as the river fishing. This is because the most valuable fish there is the salmon. They live most of the year in the ocean, but in the spring, at the breeding season, they run up the rivers to lay their eggs. At this season nets, or seines, are spread across the waters, and the salmon are caught in great numbers. A single net has brought in as many as 100,000 salmon. Of the fishing industries salmon is the second in importance in the United States.

PRESERVING FISH

Many of the salmon are sold to be eaten fresh, but the great bulk of them are put up in tins at the great salmon-canning centers on Puget Sound and on the northwest Pacific coast. In this form they are sent to distant markets in various parts of the world. Canned salmon is the largest fish export of the United States. The export of this fish alone brings in an income varying from $8,000,000 in 1914 to $15,000,000 in 1916. The salmon fisheries of Alaska yield almost as valuable an output as the gold mines.

The only fish which is more valuable than the salmon is the cod of the Atlantic, which has always held the first place. Its value is due not only to the quality of the fresh fish but, more largely, to its sale in the salted form. To the shores of New England, especially to Gloucester,

© Underwood & Underwood

FIG. 84. Scotch herring, Wick, Scotland

the trawlers bring the fish cleaned and iced. After they are landed they are split, salted, and dried on racks or benches along the wharves in enormous quantities. These salt cod reach our tables in the form of fishballs and creamed codfish. The herring are smoked and thus preserved, while the small herring are put up in tins and sold as American sardines.

SHELLFISH

In addition we also have very important so-called "shellfish" — oysters, clams, lobsters, and crabs. These are not really fish at all; they belong to a different class of animal life, but because they live in the water and have a hard, limy outer shell they have come to be known as shellfish.

Trapping lobsters and crabs. *Lobsters* are animals which can live only in cold waters and so are found off the Atlantic coast north of Delaware Bay. *Crabs*, on the other hand, can live in warm or cold waters and so can be caught from Maine to Texas. Lobsters and crabs are caught in wooden traps, called pots, which are baited and made in such a way that the animals may crawl into them but cannot crawl out. The pots are lowered to the bottom and allowed to rest there, anchored by a rope attached to a buoy which floats on top of the water. The lobsterman goes out once a day, hauls his pots, takes out the catch, rebaits the traps, and lets them sink again. The value of the 8,000,000 lobsters taken yearly on our North Atlantic coast is rapidly increasing.

Clam-digging. *Clams* are creatures which bury themselves in the mud flats of tidal bays, and are gathered at low tide by means of tongs, forks, and dredges. They may be located by little holes in the mud through which they get air.

Dredging for oysters. *Oysters* live attached to stones or shells on shallow water bottoms. The demand for oysters is so great that the natural supply is not enough; therefore they are protected and cared for so that they will be more abundant for the market. When they are

grown hundreds of boats and thousands of men dredge the sea bottom to bring them up. The center of the oyster industry is in Chesapeake Bay, where the quiet water and the mild temperatures are favorable for their

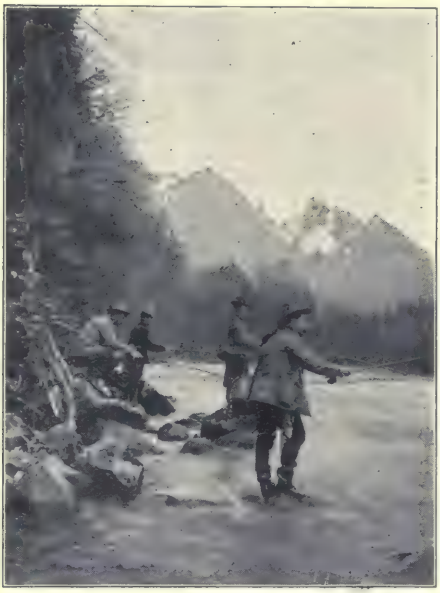
© Keystone View Co.

FIG. 85. Deep-sea fishing boats alongside the old fish pier, Boston

growth. By packing oysters in ice for shipment they can be eaten fresh long distances inland. Served raw they are a favorite dish. There is a great oyster-canning industry along the North Atlantic coast which supplies thousands of cans of oysters for all parts of the world.

GOVERNMENT PROTECTION OF FISH

Stocking our lakes and rivers. Since it is such sport to "go a fishing," especially along our ponds and streams, the government has found it necessary to provide very carefully against the killing off of the fresh-water fish, so that the ponds shall not be without fish. Many of these inland lakes would have no fish life were it not that the Bureau of Fisheries stocks them yearly with the fish which are best suited to each place. That is, they put into the ponds and streams thousands of young fish which have been hatched and cared for in the government fish hatcheries.



Courtesy of the state of Washington

FIG. 86. Trout-fishing in the Northwest

Protecting our fish. The young fish grow in the rivers and lakes until they are large enough to be caught. Fishermen are required to throw back into the water all those which measure less than the length prescribed by law. Disobedience to these laws is punished by a severe fine, and the laws are enforced by the government fish wardens. The same sort of laws have had to be made with regard to lobsters. If the lobstermen

are caught taking short lobsters they are punished by fine also. Thus, by protecting the young fish and allowing fishermen to take only the full-grown ones, the government conserves the fish life of the waters of the United States.

We have seen how each portion of the country produces a necessary part of the nation's food supply and how vital it is to make our soils and our waters everywhere give the highest possible yield. The average amount of food needed to feed the people of New York City for only one week is:

2160 carloads of grain and flour
2000 carloads of milk
1636 carloads of vegetables
760 carloads of dairy products
750 carloads of fruits
750 carloads of meats
500 carloads of livestock
324 carloads of groceries
215 carloads of poultry
206 carloads of canned goods
32 carloads of sea foods

For these products the city is dependent upon nearly every district of the United States and upon the cars and ships which daily bring into the city the food without which its people could not live.

CHAPTER V

CLOTHING — ANIMAL SOURCES OF SUPPLY

Problem. *How to provide warm clothing for the world.*

LEATHER

Skins used for clothing. Primitive people of the cooler climates have always used leather for clothing. The American Indian was a swift, sure shot with his bow and arrow, and he had no trouble in bringing down the deer and other wild animals upon which he depended for many of his daily needs. The flesh of these animals was his chief food, and the skins made the larger part of his clothing. To-day the people of civilized countries have for the most part ceased to use leather in the making of garments, but it is still used in the manufacture of shoes and in glove-making. Leather still holds a very important place in the business of clothing the nation.

ANIMAL SKINS FOR BOOTS AND GLOVES

Hides, the product of the frontier. The hides of cattle are one of the chief sources of leather. Before the days of Western railroads cattle could be raised on our Far Western plains solely for their hides and tallow. The only way in which the meat of these cattle could be eaten in the East was for the cattle to be driven there on foot and killed after reaching Eastern cities. Every spring there were great cattle drives from the nearer

portions of our Western plains. In one year more than two thousand men with thousands of horses drove half a million cattle from the state of Texas eastward.

But from farther west the cattle could not be driven to market. The meat was allowed to waste, and only

Fig. 87. Hides which have been soaked in a lime solution are being scraped to remove hair

the hides and tallow ever reached the people of the East. As settlement pushed farther and farther westward in the United States, cattle-raising was the great industry of the frontier, as it has been of the frontier in every land. This was because cattle could be raised where labor was scarce, and the hides made a valuable product which could be sent to far-away markets, even where the means of transportation were poor. As the frontier pushed steadily westward the farmer followed

the cattleman, until much of the land of the Great Plains was converted into farms, and our hides came more and more from the far-away lands of newly settled Australia and Argentina.

Tanning. The hides of cattle, horses, goats, and kangaroos are used principally for making shoes, while the skins

FIG. 88. Tanned hides being pressed in rollers and dried

of sheep, goats, and other thin-skinned small animals provide the raw materials for glove-manufacturing. The curing and preparing of these hides and skins is a very important industry and employs a very large number of people. First of all the skins must be thoroughly cleaned of all flesh on the inside and all hair or wool on the outside. Then they are soaked in liquids which contain a large amount of *tannin*, a vegetable substance which is obtained from the bark of hemlock and oak

trees. This tanning of the hides and skins makes them tough and strong and prevents them from decaying. When it is properly done the leather which results is the most durable of all clothing materials.

Making shoes. The United States has long been a great manufacturer of shoes. From a trade carried on by the wandering shoemaker who, a hundred years ago, wandered from house to house making shoes for each family in turn, shoe manufacture has developed into a great factory industry. This was made possible by the invention of the sewing machine, which stitches all parts of the shoes. The hammering and the stamping as well as the sewing of the shoes are now all done by machinery. Fifty different machines and as many operators are required to put together the many pieces of leather which make one pair of shoes. The industry has its center in New England, with Massachusetts as the leading state and Lynn and Brockton the chief shoe-manufacturing cities. Here tops of shoes made from goatskins imported from India and China and tanned in Philadelphia are fitted to soles made from hides of the cattle of our Western plains, tanned with the oak bark of our Appalachian forests. The American shoe has long been famous for its style, and our shoe-making machinery has therefore been much desired in European countries.

Making gloves. Though glove-making has never been so important as shoe-making in this country, we make millions of pairs each year. The industry is unusual in that there is in all the United States only one important center where gloves are made. More than half the gloves manufactured in the United States are made in Fulton County, New York, in the towns of Gloversville and Johnstown.

Here more than a century ago Scotch glove-makers settled and began in this country the trade which they had learned at home. There is no other reason why this region is better suited than any other for the making of gloves.

The calfskins, lambskins, and goatskins which make our gloves are not tanned as are the hides for our shoes, but are soaked in salt and alum water and treated with egg yolks to make them soft.

Rising prices. Our shoes and gloves are costing more each year. One reason is that more and more of them are needed to supply our growing population. Also great numbers of people in foreign lands who formerly wore straw or wooden shoes now want shoes of leather. Not only are there *more* people to wear shoes, but we are growing more and more extravagant, and each person now desires many pairs of boots and shoes. The price steadily increases, for the number of hides the United States produces is not increasing as rapidly as the number of people who need shoes and gloves.

WOOL

SHEEP-RAISING FOR CLIP

With the exception of fur there is no kind of clothing which keeps us so warm as wool. Wool is the fine, crinkly hair which makes the warm coat of the sheep. If many of the short hairs are twisted or spun together to make a long thread, this thread or yarn can be woven into excellent cloth. This cloth is so much needed that sheep are raised quite as much for their wool as for their meat.

Sheep-raising is a great industry on the Western plateaus and the slopes of the Rocky Mountains (see relief

map), from Montana and Idaho to New Mexico. In the days when sheep and cattle grazed together on the great unfenced free range, there was a constant struggle between sheepmen and cattlemen for the possession of the grazing lands. At that time the stealing of cattle and

© Underwood & Underwood

FIG. 89. A sheep farm in Michigan

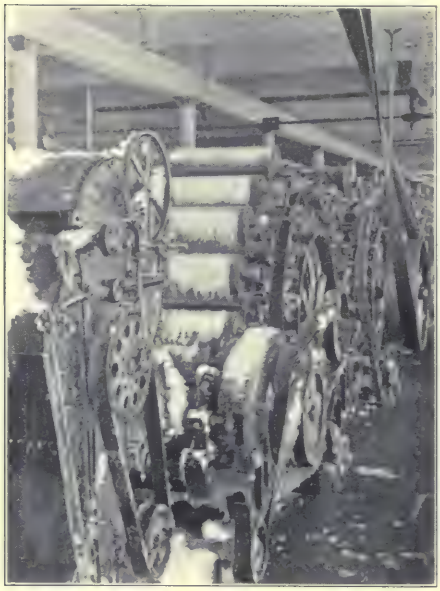
sheep was common and was punished quickly and quietly and without trial. To-day many of these lands are in the hands of private owners, who fence their great ranges and protect their large herds of sheep.

Although the two states of Wyoming and Montana are the leaders in wool production, a part of the best quality of wool comes from southeastern Ohio and southwestern Pennsylvania. In these states some of the

finest sheep in the world are raised, among them several varieties of the famous merino, whose wool makes the finest woolens.

FROM WOOL TO CLOTH

Once each year the wool is clipped from the sheep by hand with great shears or by machinery. The wool clip is then baled and sent to the scouring plants, where it is first washed to remove all the dirt, twigs, and leaves which become entangled in it as the sheep roam over the pastures. Next it is scoured with certain chemicals to remove all the natural grease and is left soft and clean. The scouring is done almost entirely in New England, because here are the purest and cleanest river waters in the country. Pure water is absolutely necessary in the cleaning, scouring, and bleaching of wool. The wool grease, which used to be thrown away, is now carefully saved. It is used in the making of many kinds of soaps, salves, and cold creams.



© Underwood & Underwood

FIG. 90. Feeding wool into a carding machine, Massachusetts

After the wool is scoured it is sent to mills to be made into many kinds of cloth. Here the wool is

combed (or carded), the short fibers spun together into thread, and the threads woven together into cloth by great power looms. All along each little hair of the wool are tiny overlapping scales. Some cloth is made without spinning or weaving, by rolling and beating the wool fibers until they are held together by these scales in a tangled mass. This makes a thick cloth called *felt*. Wool is also manufactured into shoddy, worsteds of many kinds, carpets, shawls, and hats.

Manufacturing in the East. Most of the making of wool into cloth is carried on east of the Appalachian Mountains, from Maine to Delaware. This is partly because there are many streams here with waterfalls which furnish power to run the looms of the woolen mills. It is also because there are many people in this region to supply the labor needed for the making of cloth. Since the coarse glacial soils of New England do not make good farms, her people are busy manufacturing into cloth and into shoes the wool and the leather which come from Western farm lands. Massachusetts produces one third of all our woolen cloth. Philadelphia is the leading wool-manufacturing city.

NEED FOR MORE WOOL

As our need for wool becomes greater we are forced to import more wool from Australia and South America. The Department of Agriculture is encouraging farmers to raise more sheep. Unless many farmers do this we shall face a serious shortage of wool and shall have to depend upon poorer fibers. Woolen-cloth manufacturers are each year mixing more and more cotton with the wool, until now it is difficult to buy an all-wool garment.

SILK

How and where the silkworm lives. Silk is a fiber spun by the silkworm. The silkworm lives on the leaves of the white mulberry tree and can be raised wherever this tree can grow. It is possible to raise the mulberry throughout much of the southeastern United States, but we raise no silkworms, because it requires much hard work to care for them. In crowded China and Japan there are many people willing to do this work for very low wages. But in the United States we must pay so much for labor that it is cheaper to buy raw silk in China and carry it halfway round the world to New York for manufacture than to raise the silkworm at home.

Location of the silk manufacture. The silk fiber brought from Japan, China, Italy, and France we manufacture into silk cloth and ribbons in greater quantities than any other country. The silk industry, like the manufacture of wool, centers in the northeastern United States, and Paterson, New Jersey, is the leading city in silk manufacture. Since the work in silk mills is relatively light, large numbers of women and girls are employed. The industry is located in factory towns in order to get workers from among the wives and daughters of the factory men. An important branch of the industry is the making of sewing silk.

CHAPTER VI

CLOTHING — VEGETABLE SOURCES OF SUPPLY

Problem. *How to provide more and cheaper clothing for the world.*

COTTON

Use and cost of cotton. Cotton is the most generally used clothing material of the world, and the United States produces more cotton than all the rest of the world together. A little over a hundred years ago cotton cloth was so expensive that only the rich could wear it, and the poor man must wear linen, wool, or leather. To-day it is the cheapest of all cloth.

GROWING COTTON FOR CLOTH

What makes cloth. The fiber of which cotton cloth is made comes from within the seed pod of a bushlike plant which grows in our Southern states and other warm countries. Inside the round seed pod, or cotton boll, is a soft white mass which looks like wool, within which the seeds are hidden. This covering of the seeds is made up of thousands of tiny fibers, from one to two and one-half inches long and finer than the finest hair. Each little fiber is a hollow tube, flattened and ribbonlike because it has been wound so tightly around the seed. If millions of these tiny fibers are twisted together they make one long cotton thread.

Separating fiber from seeds. It was long necessary to pull the cotton fiber loose from the seeds by hand. It took so long to do this that one person could prepare only one pound or less a day. In those days the American colonies produced almost no cotton and imported most of what they used. In 1793 Eli Whitney invented the cotton gin, a most valuable machine for separating the seed from the cotton fiber. This could do in one day the handwork of from one hundred to two hundred men. The cotton gin revolutionized the industry and meant the beginning of cheap cotton. Our Southern states at once began to grow cotton on a much larger scale to meet the growing demands, and we were soon supplying England with more than half of all the cotton used in her many mills.

Courtesy of Immigration Commission, Phœnix, Arizona

FIG. 91. Long-staple cotton

The climate cotton needs. The cotton plant is a native of the tropics and thrives in the bright sunshine and warm, rainy climate of our Southern states. It can ripen only where there are seven months without frost. But it does not yield well in regions which are all the year round hot and wet, for it is not until the weather becomes colder or dry that the seeds begin to ripen.

Map study. Compare the length of the growing season needed for cotton with that needed for wheat and corn. Locate the United States cotton belt (Fig. 92) and name the states it includes. Why is this the great cotton-producing region? What climatic factors limit the cotton belt on the north, the west, and the south?

Rich soils for cotton. Locate the areas within the belt which produce the most cotton. The climate throughout

FIG. 92. Production of cotton in the United States

the belt is practically the same. But the cotton grows best upon the river-laid soils along the Mississippi, on the fertile limestone soils of Alabama and Georgia, and on the black-loam soils of Texas (see Fig. 92).

Cotton-growing moving westward. As the lands west of the cotton belt are irrigated they make even better cotton

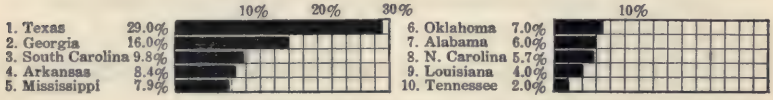


FIG. 93. Leading cotton-producing states

lands than those to the east. This is because the plants can be given much water at just the time they need it, in the early growing season, and less later when it is time to ripen. In these lands of clear blue skies and little rain the plants can also have almost constant sunshine.

Value of Egyptian cotton. The kind of cotton which grows best on irrigated lands is the so-called "Egyptian" variety, which has long flourished under like conditions in the sunny valley of the Nile. This is better than the upland cotton grown in most parts of our cotton belt,

Courtesy of Wisner Estates

FIG. 94. Growing sea-island cotton on the wet lands of Louisiana

because the fibers are longer, and fewer of them need to be twisted together to make one long thread.

The raising of Egyptian cotton has become an important industry in Arizona, on the Salt River and Yuma irrigated lands. As more of the lands of the Southwest are irrigated and more of this long-fiber variety can be produced we shall need to depend less and less upon Egypt for our supply of high-grade cotton.

Similar to the Egyptian cotton is the sea-island variety, another long-fiber cotton which grows on the plains along the coast of South Carolina and Georgia and throughout the state of Florida.

© Underwood & Underwood

FIG. 95. Picking cotton by hand

Growing the cotton. Throughout all the cotton belt the seeds of the cotton are planted in the spring. During the growing-season the stocky bushes are rich green with maplelike leaves. By midsummer time the fields are gardens of hollyhock-like blossoms, pink and white. Soon these fall, leaving little green seed-bearing bolls, which, when ripe, burst open and show the fluffy white cotton fiber ready for the picking. Throughout the season the cotton pickers gather by hand the cotton as it ripens.

COTTON MANUFACTURE

Where cotton is manufactured. After the cotton is picked and ginned the fibers are carded and are then ready for the manufacturer. Leading centers for making cotton cloth are New England, North Carolina, South Carolina, Georgia, and Alabama. For many years New

England has excelled, Fall River and New Bedford being the chief manufacturing cities. Here the climate is more moist and even than elsewhere in New England, and coal barges deliver coal at the factory wharves at low cost.

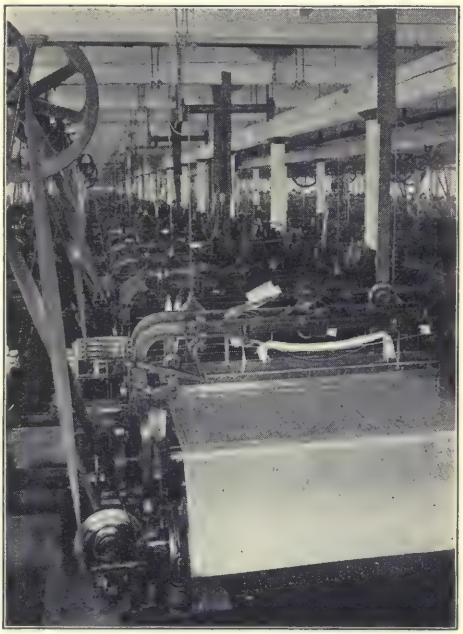
© Underwood & Underwood

FIG. 96. Drawing-frames in a cotton mill

The rapid growth of the cotton-manufacturing industry in the Southern states is due to the nearness of the cotton fields and the development of electricity to run the mills from the water power along the fall line.

Alabama is becoming more and more a maker of cotton cloth. The cotton for her mills is grown at home, and the fuel to run them comes from Alabama coal fields. The fabrics made in the Southern mills are coarser than those of

New England. Massachusetts buys cotton from the South and puts much skilled labor upon a small amount of cotton to make a high-grade cloth. The Southern states, with plenty of cotton at home and little labor, put less work upon a large amount of cotton and make a coarser product. These coarse fabrics are exported in great quantities to lands where the warm climate and the poverty of the people make coarse cotton garments needed. The United States ranks second only to Great Britain in the production of manufactured cotton goods.



© Underwood & Underwood

FIG. 97. Weaving cotton cloth

OTHER USES OF THE COTTON PLANT

The fiber of the cotton is used not only for cloth-making but also for the manufacture of hosiery, embroideries, lace, and knitted undergarments. The hulls of the cotton seed are a staple food for cattle, being about as nutritious as hay. The kernel of the seed is crushed and the oil pressed out. This is used as a substitute for lard and olive oil and for vegetable fat in making soap.

After the oil is removed the residue, called the oil cake, is ground into meal which is used as a food for dairy cows and beef cattle. Because of its nitrogen it is also used for the making of mixed fertilizers. Of our cotton crop in 1917 the seeds alone were worth $340,000,000.

NEED FOR OUR COTTON IN EUROPE

Our cottonseed oil is shipped to many other lands, and our raw cotton furnishes much of the supply for European mills. Memphis and Dallas are the largest inland cotton and cottonseed-products markets in the world, and Galveston, New Orleans, Mobile, and Savannah are great cotton-shipping ports. The world depends so largely upon this country for cotton and its by-products that a failure of the United States cotton crop would mean disaster.

DANGER TO OUR COTTON CROP

Our cotton crop has been enormously damaged in recent years by the cotton-boll weevil (Fig. 66). This insect came into this country from Mexico and since 1892 has worked its way farther and farther northward and eastward through our cotton belt. The weevil punctures the cotton boll before it opens, and deposits an egg. When the larva hatches, it destroys the fibers in the boll. In spite of everything the Department of Agriculture has been able to do, the damage done by this pest during 1916 amounted to nearly $25,000,000.

Our government is doing everything possible to help the cotton planters fight the boll weevil. It is irrigating more and more of our southwestern lands where cotton can be grown. The government is also urging farmers

to plant the varieties of cotton which have long fibers and so make finer cloth. In these and other ways it is helping to make cheap clothing for the world.

FLAX AND HEMP

Flax for linen. Another familiar cloth made from plant fibers is linen. It is of linen that your collars and cuffs

FIG. 98. Cotton in bales on the wharf at New Orleans

and many of your handkerchiefs, napkins, and towels are made. The fiber which is woven into linen comes from the inner side of the bark which surrounds the stalk of the flax plant. The fibers extend from the flower to the root of the plant and so are from 10 to 50 inches long — many times as long as the short fibers which come from the cotton boll. Because of the strength and length of the fiber, linen cloth is more durable than cotton.

Until the introduction of cheap cotton almost every American farm grew flax for its fiber and wove it into linen for household use. At present it is cheaper to use cotton than to raise flax in large quantities for clothing, because much hand labor is needed to separate the fiber from the stalks. Machines have been made to remove the fiber, but in doing so they destroy the long fiber by cutting it into pieces about an inch long. The invention of a successful machine for separating the fiber from the stalk will mean to the growers of flax and the manufacturers of linen what the cotton gin meant to the cotton industry. A much lower-priced linen cloth can then be placed on the market.

Flax for seed. Not only is the fiber of the flax of value but also the seed. Since flax grown for fiber must be pulled before it is ripe, seeds and fiber cannot be obtained from the same plant. Because of the great amount of hand labor needed to produce linen fiber, flax is grown in the United States only for its seed. To-day one sixth of the world's crop of flaxseed is grown in the spring-wheat belt of the valley of the Red River of the North. A half of the flax is grown in the Argentine Republic and one sixth in southern Russia. The seeds are made into linseed oil and linseed cake. The oil is used in the manufacture of paint, and the cake is shipped to England, Holland, and Denmark to be used for cattle feed.

Hemp for rope. Hemp is a plant very much like flax but with a coarser fiber. Hemp fiber is used chiefly for the making of rope and twine, also for coarse sacking. The chief producing areas are the Blue Grass region of Kentucky and northern Indiana.

CHAPTER VII

SHELTER — SOILS AND ROCK THE SOURCE

Problem. *How to secure building materials from our natural resources.*

Primitive homes. In every land man builds his dwelling house to suit the climate of the region where he lives and from the material which he finds there for his use. In the hot, wet lands of the tropics he needs only a shade from the hot sun and a protection from the pouring rain. He builds a simple shelter of the bamboo which grows in the tropical forest. In the cold regions of the North, where no trees grow, his house may be a little hut of snow or ice, or a cave with a clay roof to keep out the icy winds. The early settlers on our treeless Western prairies built their huts of sod. The Indian's wigwam was a simple frame of poles covered with leaves and branches or with skins. Along the deep river valleys of Arizona and Colorado the cliff dwellers used for houses the caves which they found ready-made, high on the canyon walls.

Where man shall place his home. Early peoples chose carefully where their houses should be placed. They had to be near food and water and safe from wandering tribes. Their homes were therefore built by springs or lakes and near good hunting grounds. On the plateaus of Colorado ancient people built their houses on the higher tablelands. They climbed to their dwellings by

ladders, and drew the ladders up after them so that unfriendly cliff dwellers could not follow. Thus they found protection from passing hostile tribes.

In civilized lands to-day man must build his house near to his place of work. The fisherman along the coast of

Courtesy of Denver and Rio Grande R. R.

FIG. 99. Palace of the ancient cliff dwellers, Mesa Verde, Colorado

Maine lives close by the shore of the sea, and the miller's house is near the waterfall which turns his mill wheel. Many people live in cities far from the springs which yield their water and the fields which grow their food. City reservoirs supply the water, and boats and trains bring food from many lands.

The house of to-day. The house of civilized countries is no longer merely a simple shelter for protection from rain

or cold. Many men must help to build it, and the materials which make it are brought from far and wide. It may be built of wood, brick, stone, or concrete, and the framework may be of steel.

LUMBER FROM THE FOREST

OUR FOREST RESOURCES

The lumber to build the house of wood comes from our forests. The early American settlers found most of the land from the Atlantic to the Mississippi a vast woodland. They had to cut the trees before they could plow the land and plant their grain. After the settlers had pushed across the dry, treeless plains to the West, they again found forests on the moist western sides of the Rocky Mountains. Still farther west there were dense groves of great trees, the largest in the country, on the rain-drenched slopes of the Cascade Mountains, the Sierras, and the ranges of the coast (Fig. 9).

Map study. Locate on Fig. 100 the five great forest belts of the United States. Locate the treeless belts and explain why they are treeless. In which of these belts do evergreen trees grow? trees which shed their leaves in the fall? Where do the hardwood trees grow? Name all the hardwood trees you know. Why are the trees of the Appalachian forest of the same kinds as those of the Northern forest? Why is the forest of the Pacific coast more densely wooded than any other? (See Figs. 9 and 37.)

Shifting centers of lumber supply. The first of these forests from which trees were cut on a large scale to supply lumber was the Northern forest of New England. Much lumber was cut to build houses and ships for the colonists — first in Massachusetts and then northward

in the woods of New Hampshire and Maine. Each winter great logging camps were located in the Northern woods. Here men who had farmed through the summer on the lands to the south worked all through the cold season cutting pine and spruce logs. The heavy logs were loaded in great piles on sleds and hauled over the snow to the

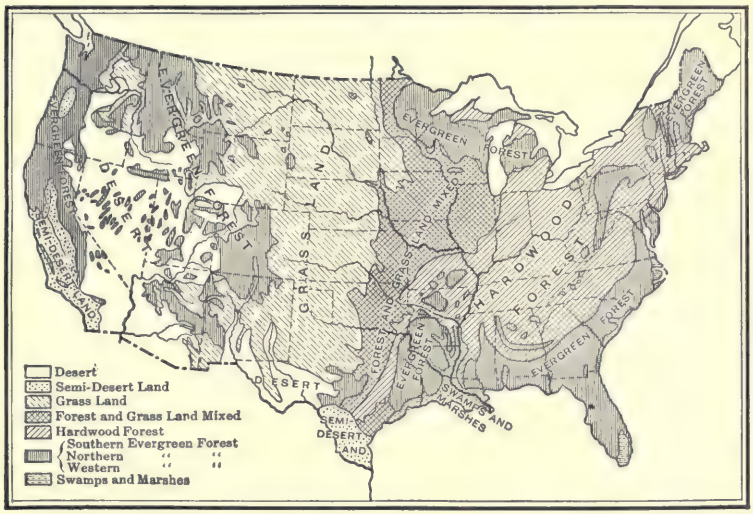


FIG. 100. Forest, grassland, and desert areas of the United States. (By Forrest Shreve, published by the American Geographical Society of New York)

nearest river. When the ice melted in the spring the logs floated down the rivers to be cut into lumber in sawmills farther to the south. When the snows melted, logs could no longer be hauled over the muddy roads. Then the lumberjacks returned to their homes, and the logging camps were deserted until the following winter. In those days Bangor, Maine, was the leading city of the lumber trade.

As the trees of the New England woods were cut the lumber industry was forced to work new forest lands.

Lumbering shifted steadily westward through New York and Pennsylvania. By 1880 the logs cut from the pine woods of Michigan and Wisconsin and shipped southward by lake to Chicago made that city the center of the lumber trade. Michigan was then producing one fourth of the lumber used in all the United States.

Fig. 101. Yellow-pine forest, Oregon

The trees of the great central hardwood forest were cut as the settlers moved to the westward, not because lumber was needed but only because it grew on land that was needed for farms. The lumber could not be sent to the East, because there were no railroads. Hundreds of maple and walnut logs which would be worth a small fortune to-day were rolled together into great piles and burned.

Soon so many of the trees of the Great Lakes forest had been cut that these states could no longer supply our

needs. The Southern States then took their turn, and the yellow pine from Southern forests replaced the white pine of the North. As the woodlands here are cut we are turning to the great forests of the North Pacific coast, and Washington is even now our leading lumber state.

FIG. 102. Dragging a log out of the forest

Forests decreasing. More than half, and the best half, of all our forests has already been destroyed. Part of the wood has been used for fuel and lumber, but much has been wasted. Each person in the United States uses in one year, on the average, ten times as much wood as each person in France and nearly twenty times as much as each one in Great Britain. If we continue to cut and waste our forests as we have done in the past, they will be gone in less than thirty years. When our own supply is gone where can we get our wood? Most of the

European countries are already importing wood. Russia, Sweden, Norway, and Austria-Hungary — the only countries of Europe which have wood to spare — are overcutting now. Their supply will soon be less, and all they can export will be needed in other European countries. China, Australia, and India all have now less than they need. South America and Mexico have only tropical woods to spare; and Canada is cutting more each year than can be grown, and cannot help us much. Therefore there will be no other lands which will have wood to spare for us.

How to care for our Forests

Preventing forest fires. If we are to have lumber for our houses in the future, we must protect our woods from forest fires. You have perhaps never thought as you saw showers of sparks shooting from the smokestack of a fast locomotive of the fearful damage they may do. On a dry summer day these sparks, lighting in the parched grass beside the track, start little fires. These smolder for a time and then, fanned by the winds and fed by the dry brush of the forest, spread in sheets of flame over the hillsides. On the fire sweeps for miles; it catches the leaves of the trees; the branches crackle in the flame, and at last the great tree trunks burn. For days the fire smolders with glowing embers, here and there, among the blackened trees and fallen logs. A gray cloud of smoke hangs over the forest, and miles away a strange yellow light and an atmosphere heavy with soot tells of the fires beyond. Other fires just as destructive are started by lightning; many spread from

camp fires or from lighted matches dropped by careless campers in the forest. In 1915 there were at least 40,000 forest fires in the United States, and an average of $50,000,000 worth of lumber is destroyed each year.

In order to reduce this alarming damage we must so far as possible prevent fires from starting. The sparks from

FIG. 103. Hauling a log to the railroad

locomotives should be caught by a cover placed over the smokestack and not allowed to reach the dry grass by the roadside. The right of way along the track should be kept clear of brush which chance sparks readily ignite. In the West, where the distances are great and there are few trains each day, automobiles fitted with wheels which run on the railroad tracks follow the trains and put out fires that start. On an average each crew puts out from six to eight fires each day.

Though lightning can, of course, not be prevented, the spread of fires thus started may be checked by keeping the ground in the forest clear of fallen branches and dry brush. All fires started by campers are due to pure carelessness. It is the duty of each one of us to see that the users of our forests take every possible care of them. What would you do to put out a forest fire? How are fires fought by the rangers in our national forests?

Careful cutting. To meet our need for fuel the dead and diseased trees and the varieties of trees which do not make good lumber should be selected. For lumber only the full-grown trees should be cut, and the young ones left to grow and produce more wood. The branches too small for lumber may be used for fuel, and the worthless twigs and tops should be piled and burned that they may not furnish kindling for forest fires. If trees are cut close to the ground no wood will be wasted by leaving tall stumps. The stumps should be left with sloping tops to allow the water to drain off, so that the center of the stump will not decay and form a nest for insects. The United States government is helping to save our wood supply by using these methods of selecting and cutting trees on the thousands of acres of woodland which it has set aside as national forests.

Preventing wood from decay. Once the timber is cut, much valuable lumber can be saved by preventing its decay. You have all seen fence posts or telephone poles which have rotted off just above the surface of the ground. Perhaps you have noticed the wooden piles of wharves or bridges bored full of tiny holes by small animals which live in the water. Or you may know that the ties of railway tracks must be frequently replaced because

constant exposure to the weather causes the wood to decay rapidly and makes the track unsafe. This wood may be made to last a great deal longer by a simple process of dipping the posts or ties in creosote — a tarry liquid obtained by distilling coal or wood. If the wood to be treated is placed in a tank full of hot creosote the heat

FIG. 104. A single log six feet in diameter makes a carload

causes it to swell, leaving more space between the particles of wood. If the log is then plunged into a tank of cold creosote the air in the small pores of the wood contracts quickly, and the creosote enters to fill the spaces which are left. Wood so protected will last twice and often several times as long as it otherwise could.

Wood is being treated in this way on a large scale by several large creosoting plants, but it can be done very simply even on one's own farm. A fire may be made in

a pit dug in the earth, and the tank of creosote heated above it. Fence posts or other wood to be used on the farm can then be placed in the tank and left until the liquid has cooled and the pores have become full of creosote so as to prevent the entrance of water or insects which cause decay.

Shingles treated in this way last as much as fourteen years, and creosoted wooden blocks make one of the smoothest and most durable pavements. Moreover, many of the poorer varieties of wood, which otherwise cannot be used for many purposes, can if treated in this way serve for ties and posts and poles as well as the better kinds of timber. If more of the wood we use were protected in this way we could save about $80,000,000 yearly, and our forests could thus be made to last longer.

Saving the trees that furnish turpentine. Ever since colonial days, when the early Carolina settlements supplied the colonies with pitch and tar and turpentine, many of our valuable pine trees have been destroyed by the wasteful methods of obtaining these products. Turpentine is made from a liquid called resin, which flows from certain varieties of pine trees when a cut is made in the trunk. The early method of gathering this resin was to cut a deep gash into the tree and allow the resin to collect in the hollow at the bottom of the cut. These deep cuts injured the trees so that they lived for only four or five years after the first gash was made. They also so damaged the trunks that they could not be used for lumber after the trees died.

It has now been found that just as much or even more resin may be obtained by frequently making small shallow cuts in the tree trunk. A metal trough or gutter is used

to carry the resin from the cut to a cuplike vessel placed at the base of the tree. Under this less severe treatment the trees live much longer, and when they die the trunks are still useful for lumber. It has also been found that a variety of French pine yields more turpentine in a short

Fig. 105. A trainload of logs going to the sawmill

time than our American pine. The United States forest service is urging all turpentine producers to use the modern method of collecting resin and to plant more French pines.

Logging and making Lumber

Giant firs of the Northwest. Most valuable and wonderful of all our woodlands are the forests of the Northwest, in Washington, Oregon, and California. Here giant fir, pine, and cedar trees grow to enormous size. The Douglas

firs and the redwoods of these dense forests rise 300 feet in height, and the lowest branches are 100 feet above the ground. The great firs are more than twice as thick

© Underwood & Underwood

FIG. 106. Boatlike rafts of lumber towed to market

through as the height of a man. It was centuries ago that they began to grow, and they were already tall trees when the first colonists settled on our Eastern coast.

Logging. The felling of trees and hauling of logs in these vast forests employs much machinery and hundreds of men. When one of these great trees is to be cut, a

deep gash is chopped on one side with an ax. Then two men with a long saw begin work on the opposite side of the tree and cut through until the great trunk falls toward the side on which the notch was cut. Men now trim off the branches, and others saw the long trunk into logs. Each heavy log is fastened to a steel chain and

Fig. 107. Lumber from the sawmill, awaiting shipment

dragged by a steam engine to a railroad which has been extended into the forest to carry the logs away. Many logs are so large that each one fills a whole car and must be lifted upon it by heavy cables operated by the engine.

Floating logs and lumber to market. From some parts of the forests the logs are dragged to near-by rivers, bound into rafts with strong chains, and floated down the mountain streams to mills on the lands below. Thousands of these logs, in the form of huge rafts, are

tugged by steamers from the ports on Puget Sound to San Francisco. Others are sawed into lumber in the sawmills of the cities on the Sound. In some forests movable engines and machinery are used to saw the logs into lumber wherever the trees are being felled. The lumber

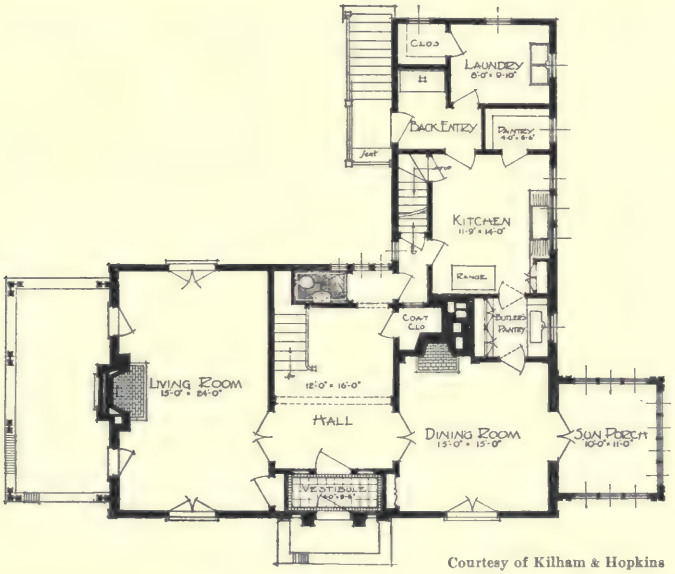


FIG. 108. Plan of a house

is then floated down through long wooden troughs, or flumes, to the foot of the mountains. There the lumber is loaded on trains or boats and hauled to market.

The machinery of the great sawmills is so perfect that logs are lifted into place by steel cranes, made square, passed on from saw to saw, and cut into lumber without once being touched by hand. The lumber can thus be made of any desired size or shape so that it may be fitted together to make houses without further sawing.

Building the House of Wood

The lumber stands for a while in the open air in lumberyards or heated kilns to dry. It is then shipped to many places, near and far, to build our wooden houses. The architect has planned the house. Laborers have dug down to find firm earth or rock on which to place it. Bricklayers, or masons, have laid strong foundation walls of brick or stone. The carpenters are now ready for their work. Fifty years ago the builder of a New England house would have found in near-by forests all the wood he used. To-day the New England carpenter lays floor beams of spruce from Maine and sets upright corner posts of Oregon fir. To these he nails boards of hemlock from Maine to make the sides, and fits in door-frames and window-frames of Louisiana cypress. He roofs the house with shingles from Oregon and adds cypress gutters to drain the roof. He lays flooring of Indiana quartered oak, hangs doors paneled with red gum from Arkansas forests, and finishes the rooms of the interior with Southern pine. Bricklayers add the chimney, the electrician wires the house for light, the plumber pipes it for water and gas, and it is ready to make man's home.

BRICK FROM CLAY

People of Assyria and Babylonia long ago built their houses of bricks made of sun-dried clay. Remains of houses centuries old, made of dried mud, or adobe, still stand in Arizona, Colorado, California, and New Mexico. In the early colonial days bricks brought from England were used for the building of the better houses.

The brick which builds the houses, chimneys, and foundations of to-day is made of clay, ground fine and mixed with water. The moist clay is molded into bars, cut into blocks with fine wires, dried, and baked in ovens. The fire brick which makes the walls of our

Courtesy of Kilham & Hopkins

FIG. 109. A modern home of wood and brick

large buildings fireproof is made in a similar way. The tiles we use for floors and hearths and roofs are made by much the same method, except that they are molded into many different shapes.

For building a house of brick skillful workmen are needed. Lime, cement, and sand must be mixed together with great care, in just the right proportions to make the mortar which holds the blocks in place. Each brick within the wall must be laid straight and true.

Clay that is suitable for making bricks is found in every state in the Union. To-day nearly every city has its brick-yard, and in many places where there are thick beds of pure clay soils near by almost all the houses are of brick.

STONE FROM THE QUARRY

Everywhere beneath the soils which cover the surface the earth is made throughout of hard rock. This is another of our valuable resources. It is all ready for our use, and needs only to be blasted loose and cut in blocks to make the stone which is used in building houses. The amount of stone quarried in the United States each year is worth about $76,000,000.

Stone for houses. The materials of the stone building may be of many shapes and kinds. The stone may be rough or polished, irregular in shape or nicely cut and made square. It may be granite, sandstone, or limestone. *Granite* is a strong and easily worked stone. It is made of small grains of two or three different minerals, and its color depends upon the color of these minerals. It may be pink or gray and is speckled in appearance. It is quarried very widely. Much comes from the Appalachians between Maine and Alabama. Granite has been in use in this country since colonial days. The dark-gray granite of Quincy, Massachusetts, was chosen for the building of Bunker Hill Monument at Charlestown. A railroad — so far as known the first with iron rails in the United States — was built to carry this granite from the quarry to the sea that it might be shipped to Boston Harbor.

Sandstone is a brown, gray, or yellowish rock. If you look at it closely you can see that it is made of fine grains

of sand — once the sands of the sea beach, now cemented together. It feels gritty to the touch. Sandstones from many states are used. They are quarried in Ohio, New York, Connecticut, Massachusetts, and New Jersey.

Limestone, the most used of all rock for building, is an even-colored, white, pale-gray, or yellow stone made in

Courtesy of the Vermont Marble Co.

FIG. 110. Quarrying marble one thousand feet underground

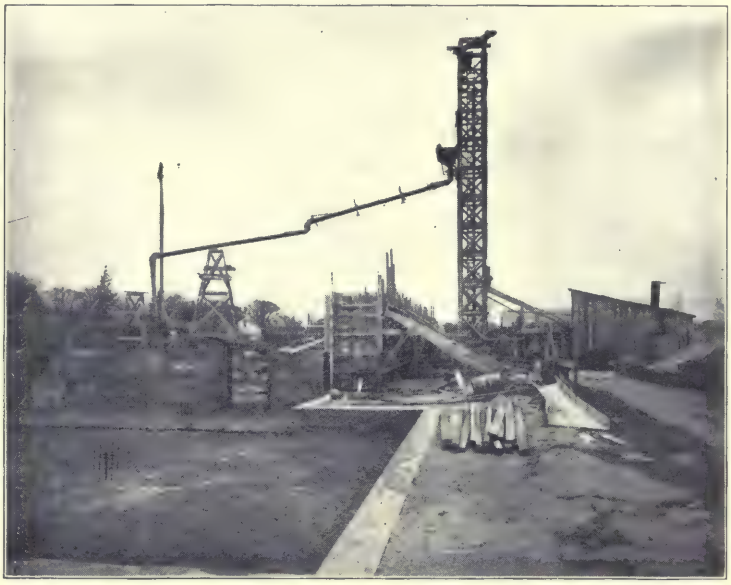
most cases of the shells of sea animals. It turns dark gray when long exposed to the weather. Some of the best limestones come from Indiana, northern Kentucky, and the Shenandoah Valley.

The *slate* to make our roofs is quarried from Maine to Georgia. *Marble*, used for the interiors of public buildings and hotels, is brought chiefly from Vermont, Georgia, Tennessee, Colorado, and Alabama.

Look at the stone buildings near your home and tell of what kind of stone they are made. Trace the routes by which the building stones have been transported from the quarries. Why were these kinds of stone selected?

ARTIFICIAL STONE

The rocks of some regions do not make good building stone, for they may crumble and cannot be cut into firm



Courtesy of Harold H. Bond Co.

FIG. 111. Shooting tower and outfit for mixing and pouring concrete into forms

blocks. Most people cannot afford to transport stone long distances to build their houses. People therefore early sought a means by which stone might be made. They discovered that if gravel, broken stone, sand, and cement are mixed with water and allowed to dry, a rocklike mass

is formed as hard and strong as stone. The Romans long ago built many of their walls and aqueducts of artificial stone. This made stone is *concrete*. It can be cast in molds in any shape desired for building blocks. It can be made at any place close by the house for which it is to be used.

Sometimes concrete is not made in blocks, but the whole wall or floor is molded in place. The liquid concrete is poured between temporary walls of wood or steel, known as forms. When the cement has hardened, the framework is removed. Sometimes, to make the concrete stronger, steel wires and beams are placed within the molds, and the concrete hardens round them. This is called *reënforced concrete*. For what is this used?

STEEL

In the thirty-story skyscrapers of to-day the framework is made of hardened iron or steel. The great rafters, joists, and beams are molded in the steel factories into just the shapes and lengths each building needs. The builders fit and rivet them together exactly as you build towers and bridges with your mechanical-construction set. And if the walls of these buildings are made of fire brick, the building is practically fireproof.

If there is no solid rock near the surface on which to place these large buildings, concrete piles or hundreds of tree trunks are driven twenty or even forty feet down, to reach a sound foundation. The earth is then removed a foot deep over the whole surface and concrete is poured in. This makes a solid base of stone around the piles, on which the building can be placed. Thus, even on made land, foundations may be firm and strong.

Thus the rocks of the earth furnish us with building stone and iron. From the clays and sands which make our soils come the brick, the artificial stone, and the forests

© Underwood & Underwood

FIG. 112. Building a skyscraper in New York

which furnish wood, all of which we need to build the varied houses of to-day. We have added to our homes comfort, variety, and beauty, but we are just as dependent upon the earth and its resources for the materials of which we build them as were the cliff dwellers or the Indians.

CHAPTER VIII

HEAT, LIGHT, AND POWER — MINERAL AND FOREST SOURCES

Problem. *How to conserve the fuels needed by mankind.*

WOOD AS FUEL

The houses of the early colonists were heated by wood from the forests, burned in the great open fireplaces, and their food was cooked in brick ovens built beside the fire or in kettles hung on cranes above the flames. Close by the blazing fire the living room was warm and comfortable. Here in the long winter evenings the family gathered, and many a long tale was told while roasting apples sputtered on the hearth and the flames cast leaping shadows on the walls.

Wood is still much used in the United States for fuel, particularly in rural districts of the forested areas where other kinds of fuel cannot be had. More wood is cut for firewood than for lumber. But as our forests and our wood supply grow smaller, wood becomes a more expensive fuel, and many others are used instead. Oil is burned on the Pacific seaboard, where it oozes from the rocks and can be easily obtained by drilling. In West Virginia and Ohio, where natural gas escapes from the earth, it is piped into the houses for heating purposes. Throughout the great coal fields and in most of our cities everywhere the common fuel is coal. To-day in many

cities of Maine, a state once covered with dense forests, coal at $13.50 per ton is a cheaper fuel than wood. The forests near the cities are now gone, so that the cost of

From Fassett's "Colonial Life in New Hampshire"

FIG. 113. An old-fashioned fireplace

cutting wood and hauling it to the city is more than that of mining coal in Pennsylvania and shipping it to Maine.

COAL

Early use of coal in America. Coal did not become an important fuel in the United States until about 1769, when Pennsylvania coal began to be known and used. People soon realized that coal burned more slowly and kept a more even heat than wood. Coal stoves began to replace the great wood fireplaces. Describe some of the early stoves.

Coal was first burned to make steam in 1825, and before many years it had come into common use as motive

power to propel our boats and locomotives and to turn the wheels of industrial machinery. The use of coal for motive power made possible the tremendous development of industry and the world-wide commerce which has brought us in touch with every nation of the earth.

HOW COAL IS FORMED

Making charcoal. Let us ignite a piece of wood and place it in a closed vessel where there is a limited supply of air. Soon the glow disappears and the fire smolders and goes out. The wood is charred — black and sooty. This is *charcoal.* It is a variety of coal made by the partial burning of wood. If taken from the closed vessel and reignited, the charcoal continues to burn as coal does and to give off heat.

Coal-forming swamps. The coal we mine was made underground in much the same way as this charcoal was made, except that the change from wood to coal went on much more slowly and without flame. It takes thousands of years to make coal. Where our coal beds are now there were long ago great swamp forests in which the ferns and horsetails grew to the size of trees. Year after year, as the leaves, twigs, and trees fell, they were covered over by the water of the swamp. This kept them from the air, so that they could not decay. This layer of vegetable matter grew thicker and thicker under the water of the swamp. After a while the growth of the forest was checked by a sinking of the region beneath the water of the sea. Slowly sands and gravels were laid down over the fallen trees, pressing down the vegetation into a more and more compact bed. Thus cut off from the air, slowly, very slowly,

the trees, leaves, and pollen changed into coal. In this way *one* bed of coal was made.

But we find not alone one coal seam, but many, one above another, varying in thickness from several inches to many feet. This tells us that many ancient forests were changed into coal. Each forest flourished under

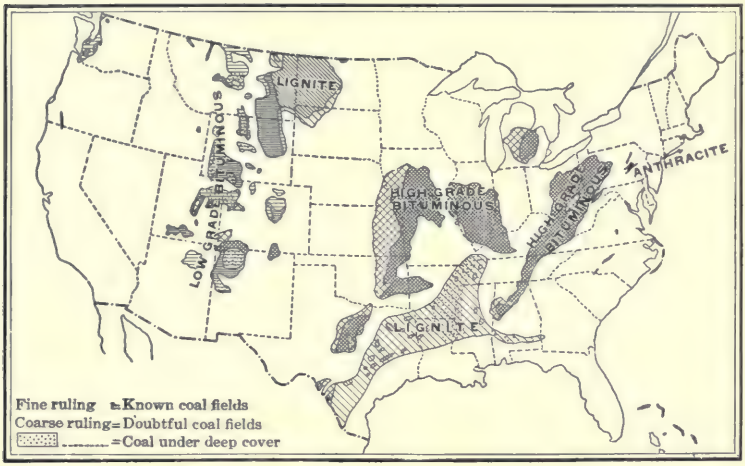


FIG. 114. Distribution of coal in the United States

swampy conditions, was buried under water, and covered by sands and gravels. When the sand and gravel filled up the shallow sea and made it land again, another forest grew and flourished, thus making possible another seam of coal.

Kinds of coal. After the wood and other vegetable matter has been buried for many years, it is changed into a soft, brownish coal called *lignite*. It is of all coals the most like wood in appearance and in the way in which it burns. It is a convenient fuel for household use. When the coal beds have been buried longer, or pressed

down by heavier layers of sands and clays, a harder, blacker coal is formed. This is called *bituminous* coal. Bituminous coal is more valuable than lignite. It burns more slowly, with a bright flame, and gives off a dense black smoke. It is a soft coal and is best adapted for making steam and for producing the high degree of heat necessary for manufacturing. When the coal layers have been still further changed, by longer burying or greater pressure, a still harder coal is formed. This is called

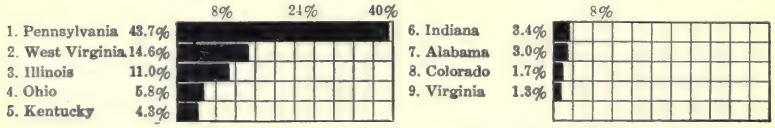


FIG. 115. Leading states in coal production

anthracite. Anthracite is a clean, hard coal which burns slowly and steadily, producing little flame or smoke. It is an ideal domestic coal, not because it has greater heating qualities than other coals, but because it can be used without producing an unpleasant, dirty smoke. Indeed, its heating power is so low in comparison with the soft coals that it is not an economical fuel for making steam or for manufacturing and is rarely used for these purposes.

Map study. Locate on the coal map (Fig. 114) the important coal fields. What kind of coal does each contain? Why is the coal field along the Appalachian Mountains a more valuable field than the coal area in Montana, Wyoming, and the Dakotas? Which of all the coal fields supplies your home city with coal? Trace the route by which the coal is carried from the mines to your city. Give all the reasons you can why so many of the great manufacturing cities are in the northern and eastern United States. Locate the coal fields of doubtful value and those under deep cover.

MINING COAL

On the sides of some valleys the level beds of coal and sand are exposed one above another like the layers of a cake. The coal can here be washed out of the cliffs by powerful streams of water. When the coal near the

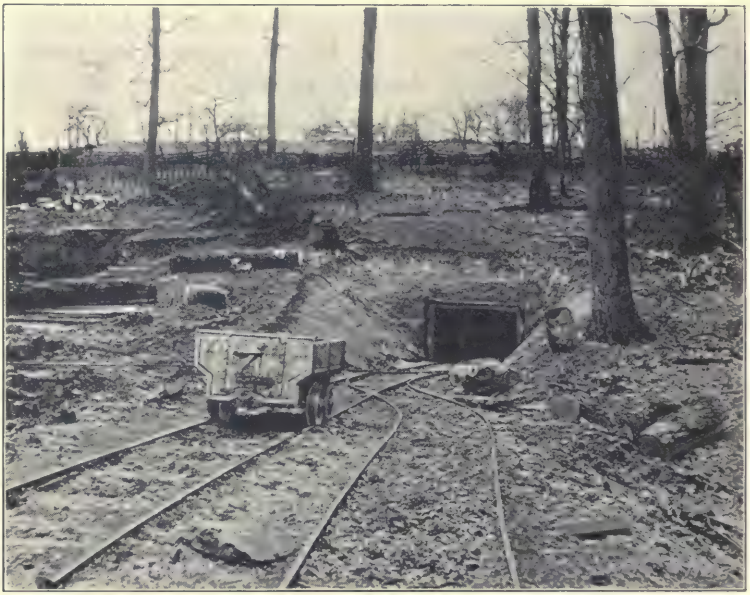


FIG. 116. Tunneling for coal; entrance to mine

surface has been taken out, a tunnel is run in to reach that which is farther back, and the coal is brought out in cars. When the coal beds lie very near the surface they may be uncovered and the coal scooped out by great steam shovels, which take out at one time a mass of earth in many cases as much as 10 feet deep and 25 feet wide.

When the coal is buried so deep that it has to be mined far beneath the surface, a third method of mining

is necessary. If we should visit one of these mines we would go through the gray and sooty mining town to the shaft house, which is built over the mine. Here

© United States Bureau of Mines

FIG. 117. Undercutting coal with a compressed-air puncher at the Experimental Mine near Pittsburgh, Pennsylvania, operated by the United States Bureau of Mines. The metal keg shown on the left is used as a place in which the two machine men keep their lamps, thus shielding the eyes and illuminating the undercut in the coal

we find an elevator which takes us several thousand feet down the vertical shaft that has been sunk to the depth of the coal.

In the coal mine. Once in the mine we find that the coal has been so removed as to leave tunnels leading out

from the main shaft. These serve as passageways along which coal is carried from the place where it is being cut to the shaft for hoisting to the surface. The coal is loosened

© Underwood & Underwood

FIG. 118. Anthracite coal on the way to the breaker, Pennsylvania

from the coal bed by dynamiting and is then shoveled into cars by hand. If a cut is made at the base of the coal bed (Fig. 117) with a machine drill before the coal is shot, less dynamite is needed and less fine coal results. Mules are taken into many mines and kept there to draw

the cars of coal back and forth; to-day many of the coal cars are run by electricity in all the larger mines.

Floods. Often it seems to be raining in the passageways of the mine, though the sun is shining brightly at the surface. The water drips constantly from the ceiling and gathers in pools on the floor below. This water is that which fell as rain on the surface days before and is gradually working its way down through cracks and pores in the rock. Occasionally there is so much water that the mine is flooded and work must cease until the water drains off or is pumped out. In some mines it is necessary to pump constantly to keep them dry enough.

Poisonous gases. To-day mines are lighted by electricity, and fresh air is kept moving through the many tunnels by electric fans. This is necessary because of the danger from poisonous gases set free in the mine as the change from wood to coal continues. Since the gases are odorless they are often not discovered before the miners are overcome by them. For protection against these gases canary birds are taken into the mines; they are more sensitive to the gases than the men, so that they are the first to become unconscious, and this warns the miners that there is danger. In other cases the safety of the miners is guarded by testing the air in the mines with a lamp protected by wire gauze. If gases which burn are present, they pass through the gauze and make the lamp burn more brightly. This warns the miner and gives him time to escape, because the wire gauze prevents the flame from spreading at once through the tunnel.

Fires. With all the care possible, the gases sometimes explode and start a fire in the mine. This may mean the

loss of life and also the slow burning of the coal that has been forming for ages and can never be replaced. Some fires that start in mines are checked by flooding, while others are prevented from spreading by walling in the area in which the fire occurs. In still other cases they burn slowly for years until the coal or air supply is exhausted.

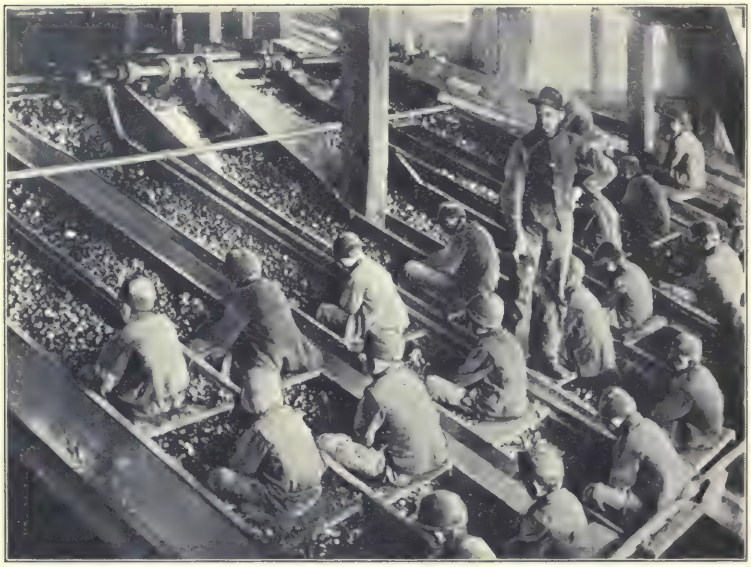


Fig. 119. Breaker boys picking slate from coal

Sorting coal. We return to the surface by elevator and follow the coal which has just been mined to the breaker house, a high building near the shaft. Here the coal, which is of various sizes and unsorted, is dumped on the top floor. As the coal passes down through the breaker house it is ground and sorted into various sizes known as furnace, egg, stove, and nut coal. Which sizes of coal do you use, and why? The pieces of rock are removed from the coal by automatic slate-picking

machines or by breaker boys. In the anthracite-coal regions of the eastern Appalachian Mountains there are still many of these boys. All day long they sit picking out the rock from the coal as it passes over the runway from the breaker. Their fingers become cut and sore from the sharp edges of the moving coal and rock, and stiff with cold. Rest is out of the question, because the overseer is constantly watching.

HOW TO CONSERVE COAL

Burn briquettes. Around the coal mines there are refuse dumps of fine coal dust, called *culm*. Any day the wives and children of the miners may be seen sifting this fine coal to find pieces enough to keep their fires burning. Even so, much of this good material is needlessly wasted. This fine coal should be mixed with tar and made into little bricks, known as briquettes. These make a cheap, low-grade fuel. Many of these briquettes are already being made in England, and more should be made in America. It would be far better to use these than to cut down our forests for fuel.

Burn coke in place of coal. When bituminous coal is burned in closed ovens the gases and liquids which it contains are given off, and the coal is changed into a harder substance, called *coke*.

We cannot make iron on a large scale without coke. Coke is also an excellent fuel for other industrial purposes and can be used for heating houses if burned in open grates or in stoves and furnaces adapted for it. Much coke is made in the Connellsville region of Pennsylvania for the manufacture of Pittsburgh iron. The gases and

liquids given off as the coal changes into coke are almost as valuable as the coke itself. From the tar thus obtained come the dyestuffs which make possible the many colors of dresses, ties, sweaters, and hats, and of our curtains and carpets. From the coal gases are also made the tri-nitrotoluol which is so much used for the making of

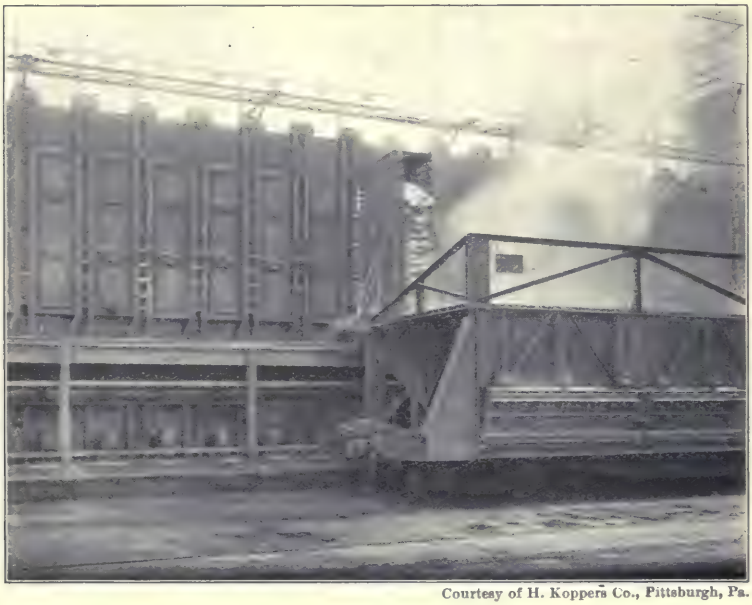
Courtesy of H. Koppers Co., Pittsburgh, Pa.

FIG. 120. Coking coal in beehive ovens, wasting by-products

high explosives, the gas which lights our houses, the ammonia needed for nitrogen fertilizers, and several thousand other useful products.

Save the by-products. In spite of the very great value of these by-products they were long let go to waste. All the coke used to be made in so-called *beehive* ovens, which allowed all of these valuable gases to escape as vapor and be lost. The modern *retort* oven not only collects and saves them all but also makes more and better coke from the same amount of coal. Though in 1914

three fourths of the coke of the United States was still being wastefully made in the old beehive ovens, there has since been such progress in this industry that in 1918 one half of our coke was being manufactured



Courtesy of H. Koppers Co., Pittsburgh, Pa.

FIG. 121. Row of retort ovens for coking coal and saving by-products. Emptying coke into cars

in modern retort furnaces. As a result of this our manufacture of dyestuffs has so increased that we no longer depend upon Europe for a large part of our dyes; we are now not only supplying our own needs but exporting more than we imported before the war.

Use soot from smoke. Every person living in a city community has noticed the gray atmosphere which clouds the sky and covers everything with a fine layer of black

dust. This dust is soot, which is unburned coal going to waste. Ways have been invented for the removal of soot from smoke and for changing it into such form that it can be burned. It is to be hoped that this material will be conserved more and more each year to help meet the demands for fuel.

Stoke carefully. There is just so much coal in the earth and no more. When coal is burned, it is gone forever. Therefore greater care should be taken in stoking, or feeding, coal into furnaces. If each person who uses coal throughout the United States were to save one shovelful of coal out of every ten, probably 50,000,000 tons or more could be saved yearly.

Why we must conserve coal. The amount of coal mined in the United States has become tremendously greater each year. The rate at which our coal production has increased since 1825 has been the greatest in the history of mining throughout the world. In mining we waste each year half as much coal as we produce. By conserving, our coal might be made to last four thousand years or more, but if we continue to use it wastefully the supply may not last more than a few hundred years.

PEAT

Another fuel of which the United States possesses large stores is *peat*. Peat is being made to-day in many of our swamps and shallow ponds in much the same way as coal was made long ago. These ponds are slowly being filled by partly decayed mosses, reeds, and grasses. The marsh becomes first a quaking bog and finally solid land, made of a firm network of intertwining roots, twigs, and leaves.

This peat, if cut out from the bogs in blocks and dried, makes excellent fuel.

The Dismal Swamp of Virginia and North Carolina, an area thirty miles long and ten miles wide, is a great peat

© Underwood & Underwood

FIG. 122. Cutting peat in Ireland

bog. Other areas which are rich in peat are many of the swampy parts of Florida and the Mississippi delta lands, the glacial areas of our Northern states, and the salt marshes of the Atlantic coastal plain. It is believed that there are 20,000,000,000 tons of peat in the United States. This great resource is now unused, but it will be of much value when our coal and wood supplies have been exhausted.

PETROLEUM

DISCOVERY AND EARLY USE

FIG. 123. An oil gusher, Oklahoma

From tallow candle to rock oil. In early days people used to follow the maxim of "early to bed and early to rise," because nearly all work had to be done in the daytime. Their houses were lighted then by the sputtering tallow candle and the greasy whale-oil lamp. These gave only a dim, flickering light, but there was no other means of lighting until it was found possible to get a better oil from rocks. This oil the Indians had long known, and the settlers of Pennsylvania discovered it when they were drilling for salt water. Oil came to the surface with the brine and could be easily separated from it, because oil is lighter than water, floats on the surface, and can be readily skimmed off. This oil was petroleum, or rock oil, and was widely advertised and sold for medicine. Very soon it became known that this oil could be separated into

many oils. One, a heavy, dark oil, could be burned to furnish heat. Another, a clear, light oil, burned with a yellow flame and made an excellent light. This light oil is called *kerosene*.

The discovery led to the invention and widespread use of kerosene lamps. Lighting by kerosene has been from that day to this the most widely used method of illumination. The kerosene lamp is much cleaner than the old whale-oil lamp, gives a steadier light than gas, and is by some much more desired for reading than is electricity.

HOW PETROLEUM IS FORMED

Just as rain water fills the spaces between rock particles and seeps through rocks, so petroleum fills the cracks and spaces between the rock grains and flows underground. The sandstone and limestone rocks in which the oil is found were formerly laid down beneath the shallow waters along the borders of the sea or in inclosed basins of salt water. The oil and the gas which is with it are the product of the slow decay of the animals and plants which lived long ago. These animals and plants became embedded in the sands just as shellfish and seaweeds are buried on beaches to-day. Sometimes during dry seasons the salt water in the inclosed basins evaporated, leaving a layer of salt. During wet seasons the basins were again flooded and sands and clays were washed in and laid down upon the salt beds until the basins were filled up or raised to make dry land. This tells you why salt and petroleum are so commonly found together in the rocks of some regions and why beds of salt in many cases indicate the presence of oil.

LOCATING AND DRILLING FOR OIL

How oil is located. Although the sands which contain oil are in some cases far beneath the surface, yet these pools of oil can be located at the surface as they lie under the folds of the rocks. In some cases the oil works

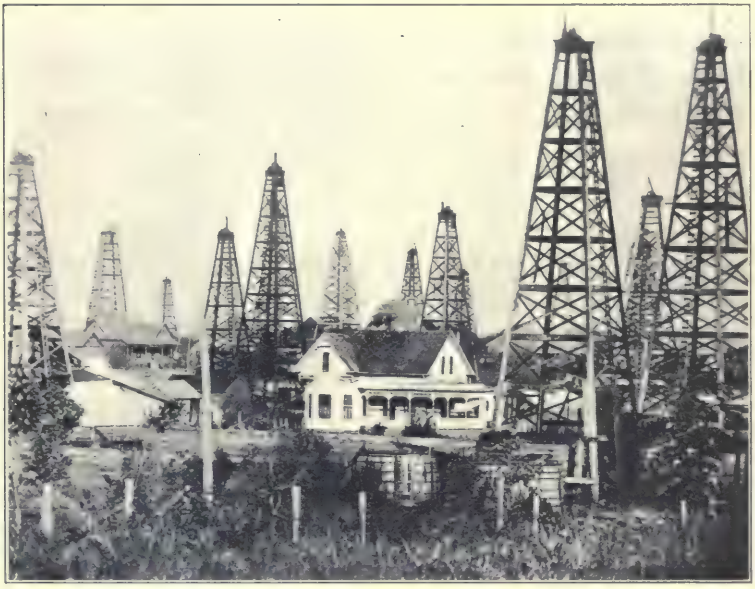


FIG. 124. Oil wells crowding homes

up through the ground to the surface, where it can be seen as an oily, tarry substance or the gas associated with it can be identified by its odor. On the Russian shore of the Caspian Sea the land is so rich in oil and gas that a lighted match held close to the ground anywhere will produce flame. Long ago the Parsees from India, coming upon these mysterious fires, marveled at what seemed to them to be everlasting flames. Believing

them to be sacred they built the Temple of Surakhany and for centuries made yearly pilgrimages of great hardship to worship at these holy Russian fires.

Early methods of getting oil. When the sands at the surface are saturated with oil, it can be made to collect in any hollow by stirring the sand around the hollow.

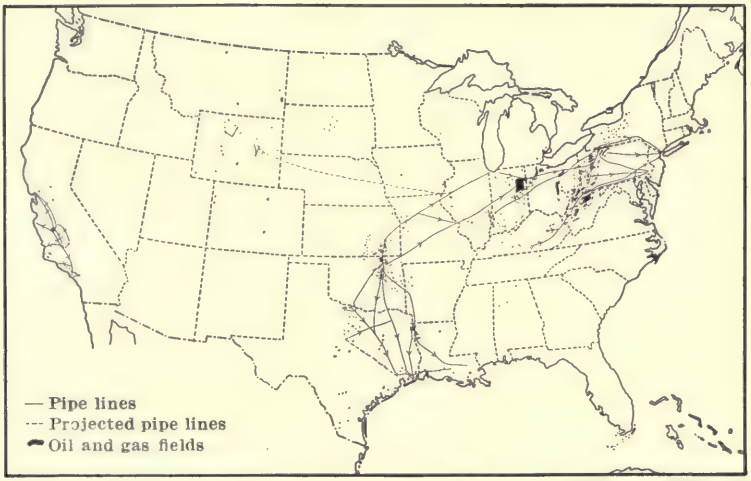


FIG. 125. Oil and gas fields of the United States with some pipe lines

Both the Indians and the colonists obtained oil from these "stirring places." Deeper wells were also often dug, into which oil and water flowed.

Drilling for oil. In 1859 Colonel E. L. Drake devised the method of bringing the oil to the surface through hollow iron pipes. He engaged two men who had had experience in drilling salt wells and set them to work south of Titusville in Oil Creek Valley, Pennsylvania. They had drilled only 69 feet when they struck oil, and this first well produced 25 barrels a day. So successful

was the undertaking that the industry swept through the valley. Many wells were sunk which yielded more than Drake's first well. Great was the surprise when from some wells the oil flowed to the surface without pumping. Occasionally the oil gushed from the wells in great quantities and shot high into the air. A well which furnishes such a fountain of oil is called a gusher. One well sunk in 1863 yielded 3000 barrels of oil a day and by 1865 had produced $3,000,000 worth of oil. So great became the excitement that wells were put down anywhere along the valley, with or without any indication of petroleum underground, and many of these never reached oil. Many hopes were blasted as well as great fortunes made. Later, when oil was discovered in other sections of the United States, the development was even more rapid and sensational, and the industry spread across the country from Pennsylvania to California and from Texas to Wyoming.

Map study. Locate on the oil map (Fig. 125) the chief oil-producing regions. These fields are (1) the Appalachian field, in Pennsylvania, West Virginia, Ohio, and Kentucky; (2) the Ohio-Indiana field; (3) the Illinois field; (4) the California field; (5) the Rocky Mountain area (Colorado, Wyoming, Utah, and Montana); (6) the Gulf area (Texas and Louisiana); (7) the Mid-Continent field (Oklahoma and Kansas); (8) the North-Central Texas field; and (9) the North Louisiana field. Which of all these regions was the first producer? Which is the greatest producer to-day? (See Fig. 127.)

TRANSPORTATION BY PIPE LINES

To be of value petroleum must be easily and cheaply transported to commercial centers. In early days the oil had to be carted in barrels. To-day it is transported to some extent on the railroads in tank cars. But because

railroad transportation is so expensive, in many regions underground pipes have been laid through which the oil flows to market. The laying of these pipes is very expensive, but once laid there is no further cost. In 1914 the value of one mile of pipe line in California was $20,000;

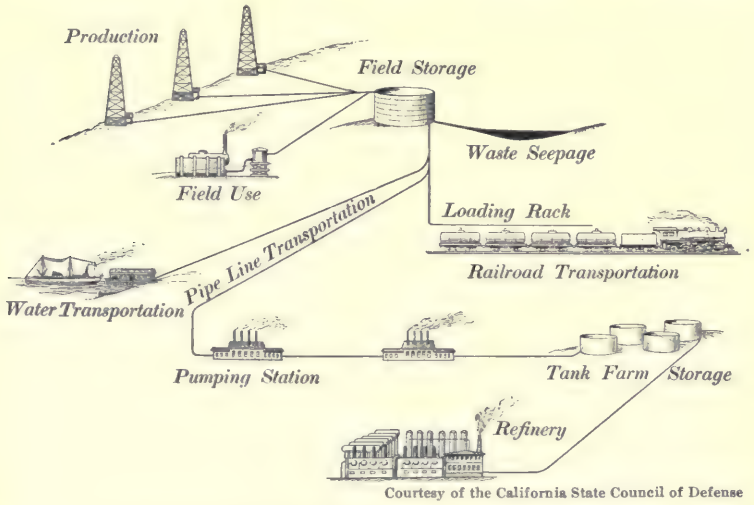


FIG. 126. Oil production, from derrick to refinery

in 1917 it had increased to $40,000. This expense has made impossible the laying of pipe lines across the Rocky Mountains and has cut off the oil of the Pacific coast from the more eastern markets.

USES OF PETROLEUM

With the exception of iron, there is no mineral resource which supplies such a large variety of needs as petroleum. One third of our petroleum is used for fuel. It is burned for heat in homes and for motive power in power plants, factories, locomotives, and steamships. The use of crude

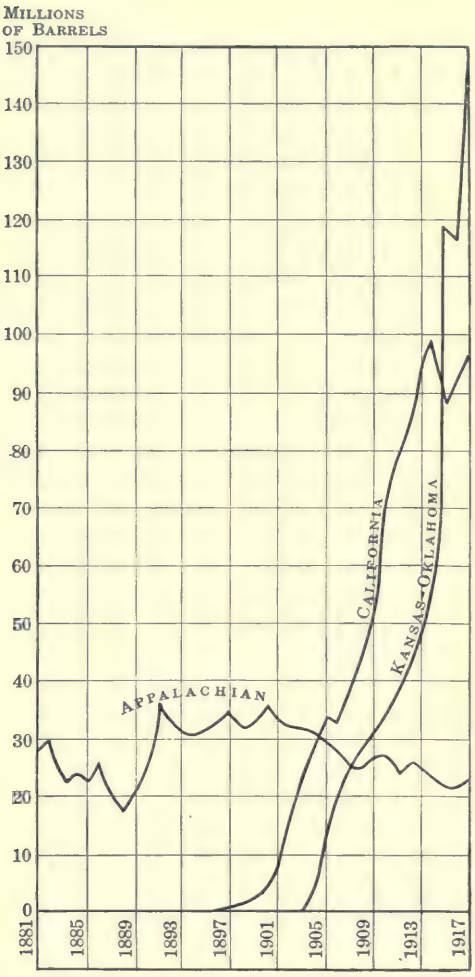


FIG. 127. Rapid increase in production of California, Kansas, and Oklahoma oil

oil for fuel is especially widespread in California, for the reason that coal is scarce and expensive in that state and oil is abundant and cheap. This large use of crude oil for fuel is unfortunate, because the lighter oils which can be obtained from the petroleum are thus wasted.

By a heating process, called *refining*, paraffin and the light oils — gasoline, benzine, and naphtha — are separated from petroleum. In addition to these products there is left a heavy oil which is just as good a fuel as the crude oil. From the heavy oil we also get the lubricants which ease the running of machinery. Among the refined products gasoline is the most used. It is invaluable for lighting purposes and for cleansing.

Most important is its use to drive automobiles, motor trucks, motor boats, submarines, and aëroplanes.

DANGER OF A SHORTAGE

The United States is producing to-day two thirds of the world's supply of petroleum, and at present we are

FIG. 128. Trapshooter well, discharging twenty-two thousand barrels of oil a day, showing overflow from tank

using more than we produce. This shortage is being made up by drawing on our reserve stored supply, which is disappearing at an alarming rate. When this is gone we shall face a shortage which will seriously damage the business of the country. It is therefore necessary to take great care not to waste the oil supply, but to use it in such a way as to get the most value out of it.

The producer can help conserve the supply by using more care in the oil field. At present he is wasting half of the oil which he takes from the earth by allowing it to run to waste or to evaporate in open storage tanks. Careful capping of wells to prevent wasting by overflow,

Courtesy of Roswell H. Johnson

FIG. 129. Waste of oil by fire

and the storage of oil in covered tanks, would do away with a large amount of waste. Too often destructive fires, caused by lightning, destroy whole tankfuls of oil. Methods are being devised to prevent this waste.

The user also can help by not burning crude oil but by using only the residue left after the light oils have been removed by refining. Petroleum is needlessly used to drive engines over 32,000 miles of railroad in the United States where electric power could be substituted. The Chicago,

Milwaukee, and St. Paul Railroad is already running its trains by electricity over the passes of the Rocky Mountains.

Oil for ships. The oil saved by electrifying railroads and by using other fuels in homes would help to supply petroleum for ships. The United States government has ruled that all new navy vessels shall burn oil, because ships with oil-burning engines make better speed than those with coal-burning engines and are not dependent upon coaling stations but can be supplied with oil at sea from other ships. Moreover, oil takes up less room in the vessel than coal and can be turned on and off like water, thus doing away with the necessity for stokers.

Much petroleum can be conserved by less wasteful use of gasoline for motor cars. There is just so much petroleum in the earth, and when it is used up it can never be replaced. Therefore it is our duty to use our limited supply wisely and to avoid every waste.

NATURAL GAS

Need for saving gas. The *natural gas* which is associated with petroleum is the best of all fuels and where found can be piped directly to houses for heating purposes. Unfortunately the cost of transportation makes it impossible to use the gas far from the source of supply. It is much used in western Pennsylvania, southern Ohio, central Indiana, Kansas, Texas, and parts of Illinois.

In drilling for oil the gas often escapes to the surface in great quantities, and many oilmen let it go to waste in spite of the fact that the gas is so rich in gasoline that as it escapes from the wells the surrounding trees and derricks are dripping with gasoline. So

much natural gas has been allowed to escape unused in West Virginia that the waste has been as great as if forty-five tons of coal had been dumped into the sea every minute for twenty years. In other states the waste has been as great, and the loss to the nation alarming. If this gas were stored and used wherever possible a large amount of petroleum or coal could be saved.

Questions. Imagine that the world supply of petroleum, coal, and natural gas should cease immediately. What would be the effect on commerce and manufacturing? Consider the best motive power for railroads and ocean liners. Give reasons for your choice. How is gas for illumination obtained along the Atlantic seaboard? in Kansas? in California? In what ways have the coal mines of the United States increased our national importance?

WATER POWER — A SUBSTITUTE FOR COAL

As our supplies of petroleum, natural gas, and coal grow steadily smaller the necessity for some other power in our factories becomes greater. In the year 1917, owing to war conditions, the railroads of the country were unable to take care of the great amount of freight to be handled. As a result many parts of the country were unable to get coal, and many factories were forced to close. This brought suffering to working people, money loss to manufacturers, and hindered the government seriously in carrying on the war. Is there no other power to do the work of coal and save us from such dependence upon it?

Water doing the work of coal. Long before we first mined coal the miller placed his mill wheel at the river falls, and the water, falling constantly upon the wheel, kept it steadily whirling round. Unlike coal, which once burned is gone forever, the waters of the river can be

Fig. 130. Mill wheels turned by water power

Fig. 131. Making hydroelectric power at Great Falls, Montana

used to turn the mill wheels at each fall, and the force is just as great at the last fall downstream as at the first. Though year after year this power is used, using it will never cause it to grow less. The weight of the falling water turns the wheels of dynamos which generate the electricity. Water power is thus changed into hydro-electric (water-electric) power. Electric power can also be

Courtesy of Duluth Chamber of Commerce

FIG. 132. This falling water makes the electricity which lights Duluth

made by the use of coal. Coal is burned to make steam, and the force of the steam turns the wheels of the dynamos which produce the electricity. But hydroelectric power is much cheaper than coal-made electricity and is the most economical motive power for factories. Formerly water power could be used only near the streams, but hydroelectric power is being carried to cities as many as 300 miles away from the falls which produce it. There it is used in factories and to supply light and heat. Although the water power from our falls is abundant and cheap, we are letting a large amount of it go to waste. To-day

the unused power from our waterfalls is 19,000,000 horse power, or the working strength of 19,000,000 horses. If we were to use this power instead of coal, one fifth of our coal production could be saved each year.

Regions which have abundant water power are those which have plentiful rainfall to supply water for many and large streams, and steep slopes down which the streams may fall producing power. If the power is to be used throughout the year, there must be either rainfall at all seasons or winter snows in the mountains which melt slowly through the summer and prevent the streams from drying up in the hot season.

FIG. 133. Cities along the "fall line"

Questions. Locate regions where one would expect water power to be abundant (see relief map and Fig. 9). As rivers flow from the Piedmont Plateau to the plains of the Atlantic and Gulf coasts the waters fall, producing water power. This line of falls is known as the "fall line." Why are hydroelectric power plants associated with our irrigation projects? Why is Buffalo a great manufacturing center?

Thus water power is one of our greatest natural resources, and is the power we shall depend upon more and more in the future for manufacturing, transportation, and lighting. The United States is very fortunate in having so great an abundance of water power which can be used to do the work of coal.

CHAPTER IX

MANUFACTURED PRODUCTS — MINERAL AND FOREST SOURCES OF SUPPLY

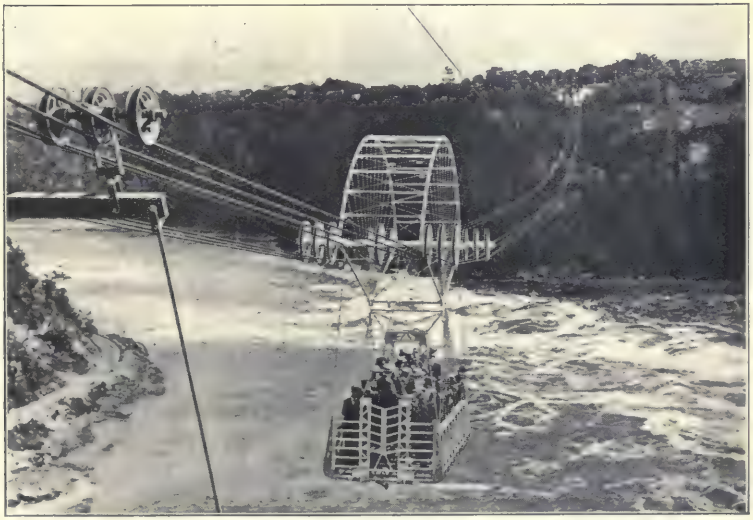
Problem. *How iron and fuel can be made to save man power.*

IRON AND STEEL

ESSENTIALS FOR ALL INDUSTRY

We have seen how man provides food and clothing and shelter to satisfy his three fundamental needs. It would be impossible for the dense populations of to-day to be supplied with these necessities if it were not for tools and machinery made of iron or steel which make it possible for one man to do the work of many. The grain which makes a large part of his food is planted and reaped and threshed by machines of iron and steel, ground into flour by steel rollers, carried from the mills to the place where it is used in trains drawn over steel rails by steel locomotives, and baked into bread in stoves of iron. The wool which makes his clothing is clipped by steel shears, spun by steel spindles, and woven into cloth upon steel looms. The house which provides him with shelter is supported by steel frames or held together with steel nails and screws and rivets, closed by doors hung on iron hinges and fastened by iron locks, and heated by stoves or furnaces of iron and steel. Every manufacturing industry has one necessity in common with every other, the necessity for iron. All the machinery in our factories is made

FIG. 134. Bridge at Hell Gate over the East River, New York, the longest steel arch bridge in the world



© Underwood & Underwood

FIG. 135. Steel cableway for crossing Whirlpool Rapids of Niagara River

of iron and steel, and without machinery no manufacture would be possible except by hand. What manufactured products made of iron or steel do you know?

SOURCES OF IRON

How iron ore is formed. Iron exists united with other substances in our soils and rocks everywhere. It is the iron present in soils which gives to many of them their red or yellowish color. We cannot use this iron, because it is so widely scattered through the rocks that it would not pay to handle so much rock as would be necessary to get so little iron. But waters moving through the soils and rocks dissolve the iron and lay it down in shallow water. Later these iron deposits are raised to make dry lands. In this way iron is brought together in large enough quantities to be mined. Rock which contains enough iron to be profitably mined we call *iron ore*.

FIG. 136. Machinery saving man power

Our iron resources. Though the United States is surpassed in iron ore resources by Brazil and China, our country mines more iron ore than any other country in the world. About one fourth of the world's supply of ore

comes from the region around the western end of Lake Superior (Fig. 137). Large iron-ore deposits are also found in the Appalachian Highlands, and smaller deposits are scattered over the western part of the United States.

FROM ORE TO STEEL

Mining. Iron ore is mined in much the same way as coal. If the ore is deep underground a shaft must be

FIG. 137. Iron-ore regions and the movement of iron ore on the Great Lakes

sunk to the ore beds and the iron brought to the surface in elevators which run up and down the shaft. If the ore is near the surface, as in parts of the Lake Superior iron region, it is scooped out from open-pit mines with

great steam shovels which load it onto cars. These carry the ore to the wharves on Lake Superior. Here the bottom of the car is let drop, and the ore falls down long chutes into the holds of the vessels in the water below.

Shipping ore on the Great Lakes. Vessels carry the iron ore across the Lakes to the great iron furnaces of the cities on the southern shores. Here the iron is separated

Courtesy of Commercial Club of Duluth

FIG. 138. Loading coal at a modern dock on the Great Lakes

from the ore rock. This process is called *smelting*. The great amount of ore shipped from Lake Superior mines has made the tonnage passing yearly through the Soo Canal greater than that of any other canal in the world. The ore is carried to Chicago, Cleveland, Pittsburgh, Buffalo, and Gary to be smelted, because the Lake Superior region has no coal. Since it takes at least two tons of coal to smelt one ton of iron ore, it is cheaper to carry ore to cities near the Eastern coal fields than to carry coal from these fields for smelting the ore at Duluth.

Map study. Locate (Fig. 137) the iron-ore areas around the Great Lakes. Which of these areas is the greatest producer? To which city is the greatest quantity of iron ore carried? Trace the route which ore follows from Mesabi to Pittsburgh; to Chicago.

Smelting. To smelt the iron from the ore rock a very hot fire is needed. This can be made by forcing a steady, strong blast of air into the fire to make the fuel burn faster and produce more heat per minute. In the early days of Rome iron ore was smelted in holes dug in the earth on hilltops. A funnel-shaped tunnel was cut leading from the side of the hill to the bottom of the pit. Iron ore and charcoal were placed in the hole, and on windy days the wind blew through the tunnel and kept the charcoal fire burning with a flame hot enough to melt the iron. When the wind failed to blow work ceased. Soon a forge was made which could be used on any day. The ore and charcoal were placed in an open stone or brick furnace, and the air was pumped into it with a hand bellows through a hole near the bottom. One of these forges could make about twelve pounds of iron a day.

This method of making iron was as unsuited for supplying the amount needed for modern industry as a one-horse cart would be for handling modern railway traffic. Iron is now smelted in great furnaces, a hundred feet in height, which are lined with fire brick and into which air is forced by pumping engines. This blast furnace once started is kept running day and night for as much as three years without once stopping. The furnace is filled from bottom to top with layers of iron ore, limestone, and coke. The coke burns, the iron melts from the ore and, being heavy, runs to the bottom of the furnace, and the impurities which the ore contains combine with the limestone

to make useless slag. As carloads of coke and ore are poured into the furnace at the top, streams of white-hot molten iron flow from the bottom. The liquid metal runs into troughs, called *pigs*, made in sand on the floor below, and hardens into long bars of pig iron. This is an impure and brittle iron, and must be purified to make the soft and easily worked *wrought iron*, or hardened to make *steel*.

FIG. 139. Making steel in the Bessemer converter

Making steel. If the impure iron is to be made into steel it is not allowed to cool and so harden, but is drawn off from the blast furnace into huge buckets made of steel and lined with fire clay. These buckets, which have a capacity of from 15 to 30 tons, are mounted on wheels and, drawn by locomotives, they carry the molten iron and pour it into great pear-shaped retorts known as converters.

A strong blast of air is then forced through the tons of red-hot liquid iron held in these vessels, and the impurities which the iron contains are thus burned out. Sheets of flame and showers of sparks shoot from the open mouths of the great converters, and at night the sky glows red

above the steel mills. When the blast of air is stopped, after a few minutes, the molten metal in the converters is nearly pure. If allowed to cool, it would make a soft iron which could be readily hammered into any shape desired. To make the hard steel needed for rails and beams and girders certain minerals must be added to the molten iron. A mixture of carbon, silicon, and manganese is therefore poured into the converters. This makes the whole mass of metal boil violently, and the added carbon is thus distributed evenly throughout the mixture. The foaming steel is white and looks like boiling milk. The molten metal is now poured into ingots and allowed to cool. This is known as the *Bessemer process* of steel-making. A Bessemer converter turns out 20 tons of steel in a few minutes and 1000 tons in a day. Its use meant the beginning of cheap steel. A newer way, known as the *open-hearth process*, is a more difficult, slower method, but makes a better steel.

Steel-making cities. Pittsburgh, the earliest-developed iron and steel city in the United States, is still the leading center. Formerly the furnaces were fed by iron from the mines near at hand and by coke which was made from the best Pennsylvania coal at Connellsville, forty miles away. When the richer stores of iron ore around Lake Superior were worked, Pittsburgh began to depend upon this region for ore. The industry is now becoming more and more important in those cities on the southern shores of the Lakes to which ore from Lake Superior mines can be brought by boat without the added cost of railroad transportation. Some iron to supply Western markets is now being made also at Duluth with coal brought by ships on their return from taking iron to Eastern coal fields.

A growing rival of the Northern steel-manufacturing centers is the Birmingham, Alabama, iron region, where the southern end of the Appalachian Highlands provides rich stores of iron ore, coal, and limestone. Here steel can be made more cheaply than in any other city because the three substances needed for the smelting of iron are all here in abundance. This area is bound to become a great iron-manufacturing center, and in the future it may outstrip the earlier-developed cities.

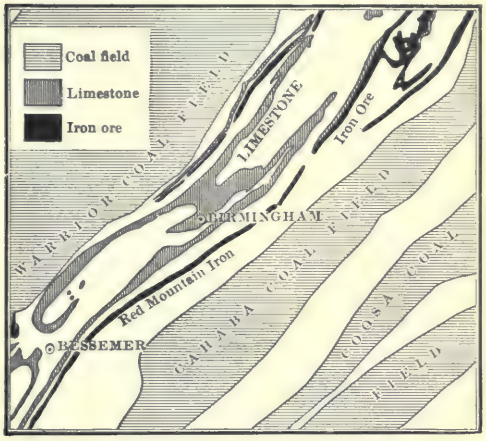


FIG. 140. Birmingham district, Alabama, showing relation of iron ore, limestone, and coal

A newer center for making steel is developing in Colorado. Here Rocky Mountain stores of iron and coal are being changed into steel to supply the needs of Western cities far distant from the greater centers of the East.

Re-using iron. Unlike coal and petroleum, iron is not destroyed when it has once been used, but may be used again and again. The scrap iron which is collected in this country each year is remelted to make half of all the pig iron produced. We should be very careful, therefore, to save all old iron and protect it from rusting. Thus we can help to conserve the great iron supply which, together with coal, has made this country an industrial nation of first rank.

COPPER

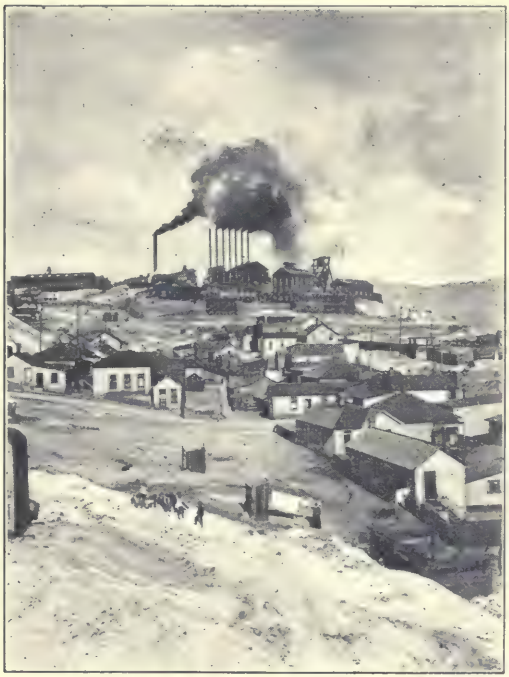
Uses. Though iron is the most useful of all metals, it is not the only one needed for the carrying on of modern industry. The water power which is converted into electricity by great *steel* dynamos is carried by copper wires to the factories where it is used. Copper wire makes possible telephones and telegraphs. In our homes are used copper boilers, kettles, lamps, and many articles of brass and bronze, which are made by mixing copper with zinc or tin. Copper is one of the necessary materials for modern warfare. It is used for shell and cartridge containers, for field telephone lines, and for wire entanglements. In January, 1917, the allied governments ordered from the United States for war use 200,000 tons of copper — the largest single order in history.

REGIONS OF PRODUCTION

Keweenaw copper. In the storehouse of the earth are large quantities of copper. The United States produces more than any other country. The first copper mines to be worked on a large scale in this country were those of Keweenaw Point, Michigan, south of Lake Superior. There pure copper occurs in such large masses that it is often necessary to cut them before they can be lifted from the mine. Much of the metal is also found in small nuggets and in tiny grains in the pores and cracks of the rock. The copper mines of Keweenaw Point are a mile deep — the deepest mines in the world.

Smelting copper at Butte. Situated at Butte, on the hill slopes of the Rocky Mountains in Montana, are famous copper mines which now excel in production those of the

Lake Superior region. Since the copper of Montana is not in its pure form, it is necessary to separate it from the elements with which it is combined. The rock is crushed to a powder and washed so that the lighter, worthless particles may be washed out, leaving the heavier particles, which contain the copper. These are roasted in smelters in order to drive off the sulphur with which the copper is combined. These sulphur fumes from the smelters, killing the trees and grass, leave the hillsides around Butte and Anaconda brown and barren.



Photograph by N. A. Forsyth

FIG. 141. Anaconda Hill, near Butte, Montana

Copper in Arizona. Since 1910 Arizona has been first among the states in the production of copper, the industry centering around Bisbee and Clifton. Arizona and Montana together produce more than half the copper of the world. Arizona mines are famous for supplying beautiful specimens of blue azurite and green malachite compounds of copper, which are used in the making of jewelry.

COPPER FOR THE FUTURE

As there is very much less copper in the earth than iron, our future supply would be very doubtful if it were not that this metal can be re-used many times. The recent increased demand for copper has caused many companies to work through the great piles of waste around the mines, to get the small amount of copper it contains. New and cheaper processes of separating copper from ore are now known and have made it possible to use low-grade ores which contain only a very little copper. Thus we are obtaining copper from new sources and also conserving, by re-use, the copper which has already been mined.

ALUMINUM

Another mineral which gives great promise for the future is aluminum. This is the commonest of all metals and can be found in nearly all rocks. But the expense of obtaining it from the rock has been so great as to prevent its widespread use. It is most familiarly known in the form of kitchen utensils.

A possible substitute for silver, iron, and copper. As soon as it is possible to obtain it at low cost, aluminum, because of its abundance and its many good qualities, can be substituted for various other metals. Its silver-white color makes possible its use in place of silver. Because of its strength and lightness it may make an excellent substitute for iron in the construction of aëroplanes and automobiles. Because it can be drawn into wire, transmits electricity readily, and does not rust or waste easily, aluminum is even now in a few localities replacing copper for the making of telephone wires. In

some regions of the Northwest, however, aluminum wires have been found unsatisfactory, because snow clings to them more readily than to copper wires and they are more likely to break in winter storms. Without doubt aluminum will be of great value for short-distance lines and in mild climates.

OTHER METALS

There are other minerals — lead, zinc, tungsten, tin, and many more — which also play an important part in manufacture and of which, with the one exception of tin, the United States has large supplies.

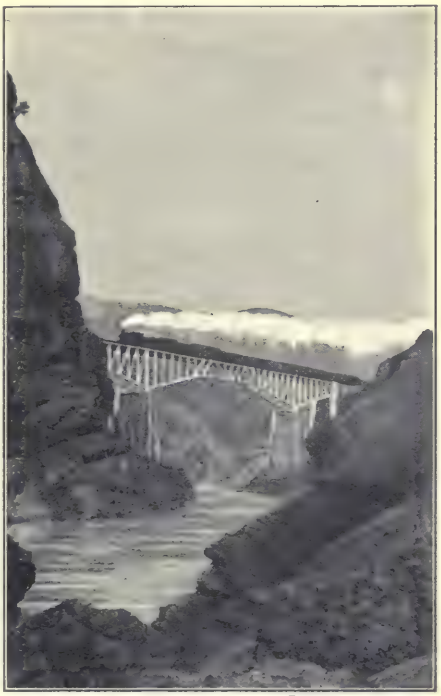
AGRICULTURAL MACHINERY

Upon iron and steel and other metals depend a thousand other industries. In the West, where the farms cover thousands of acres and their output feeds millions of people every year, farm machinery is what makes production possible. The great harvesters, binders, reapers, threshers, and all the infinite variety of tools and agricultural machinery are made principally of iron and steel. Even on the smaller farms of the eastern part of the country, where more of the work is done by hand, farming tools of iron and steel are used. Chicago is the great center of production of agricultural machinery, since it is the leading city of the broad interior plains and prairies and the machinery made there can easily be shipped to all parts of the farming lands. Other cities important in the manufacture of farm machinery are Richmond, Indiana, and Peoria, Illinois, both in the midst of the grain-growing area where the machinery is to be used. The United States excels every other nation in the

amount of agricultural machinery produced. Because of their cheapness, lightness, and the ease with which they can be repaired, our farm machines are exported to many countries, — Australia, Argentina, and even to the United Kingdom.

RAILS, CARS, AND LOCOMOTIVES

Iron and steel make possible our great railroad systems. Not only the rails but all our locomotives and even the cars and coaches are for the most part made of steel. Thousands of miles of steel rails are manufactured each year, and Philadelphia makes more locomotives than any other city in the world. This city and Schenectady, New York, together make more than half of the United States supply.



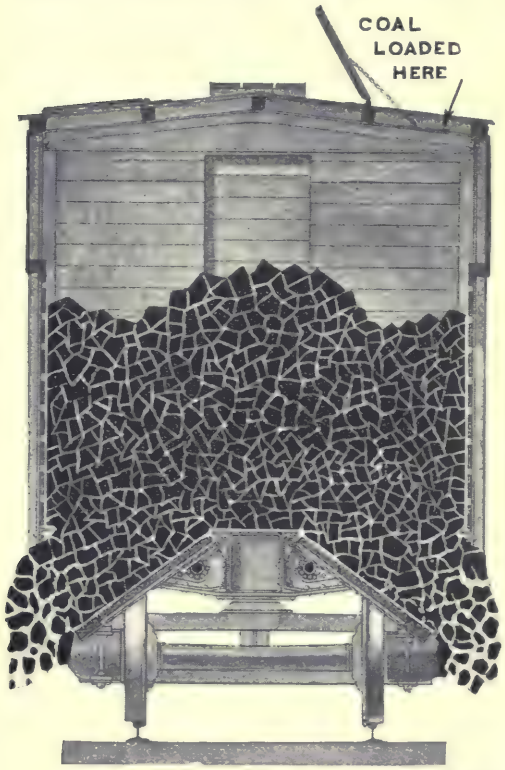
© Keystone View Co.

FIG. 142. A locomotive crossing a steel bridge, Frazier River

Shortage of cars. There has recently been great delay in the handling of freight by railroads as a result of the shortage of freight cars. A part of this difficulty was caused not because there were not enough cars but because different kinds of cars are needed for carrying different kinds of freight. There might be plenty of coal cars on

hand in a freight yard, but they were of no use if it happened that cattle were to be shipped and not coal.

Convertible freight cars. This difficulty has led to the recent invention and manufacture of a new variety of car which may be used for various kinds of freight. If live stock is to be transported, the car is so arranged as to have a flat bottom, swinging side doors, and removable ends for ease in the loading and in unloading. The car is also used in this form for the transportation of all kinds of freight which must be lifted from the car instead of being dumped. If ore, coal, or any other rough freight is to be carried in the car, the floor may be so changed that it slopes downward from the center toward each side, where there are doors which can be opened to dump the load. The ore or coal slides readily down the sloping floor and drops through the doors into

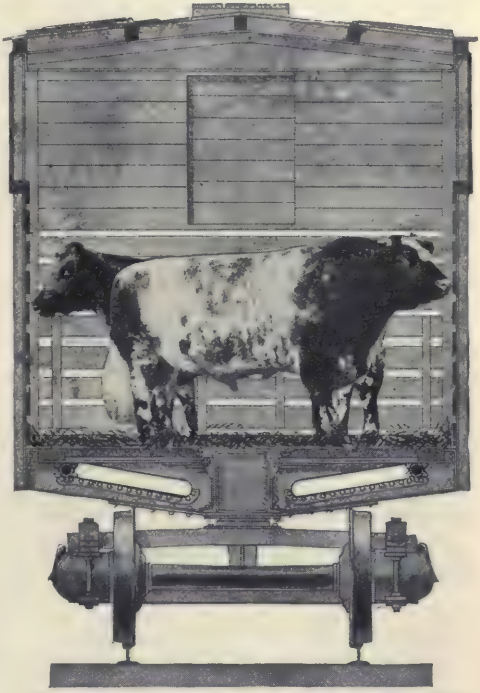


Courtesy of *Railway and Locomotive Engineering*, New York

FIG. 143. Car with doors for unloading coal or rock

chutes, or bins below. For the loading of the freight there is an opening in the top of the car (Fig. 143).

This form of car is also of much value for handling crushed stone used for repairing railroad beds. If the cars are loaded with crushed stone and the doors opened, it is distributed evenly along the track as the train is moving. Thus man power is saved. These cars, which are made entirely of iron and steel or partly of wood, are now in use on many of our important railways.



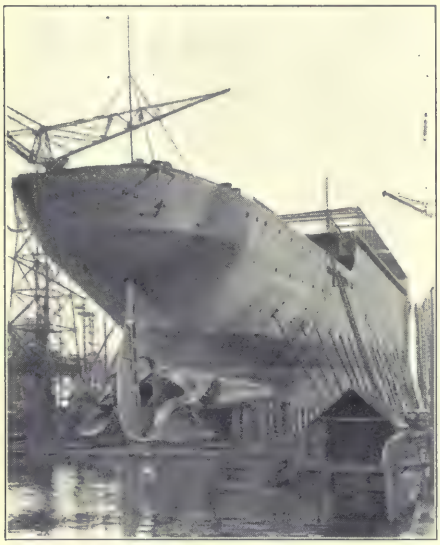
Courtesy of *Railway and Locomotive Engineering*, New York

FIG. 144. A convertible car arranged to carry animals

SHIPS

In early colonial days and up to 1850 ships were built only of wood, and New England, with its abundant forest, was the greatest shipbuilding region. After 1850 ships began to be made of iron and steel, and the industry shifted to states farther south which were nearer coal fields and iron ore regions and so could obtain steel more cheaply. Because of the greater strength of steel, steel ships can be made more durable, larger, and of more varied shapes than

those of wood. Shipbuilding must, of course, always be confined to the coast and the banks of the broad, open-mouthed rivers, for the ships, after being built, cannot be transported overland, but must be launched into the water. The hulls of the ships are built close to the shore, upon "ways" built of wooden blocks which slope toward the sea. When the lower part of a ship is finished the props are knocked away, and the ship glides down the incline into the sea. The masts and machinery are added as the ship lies at the dock.

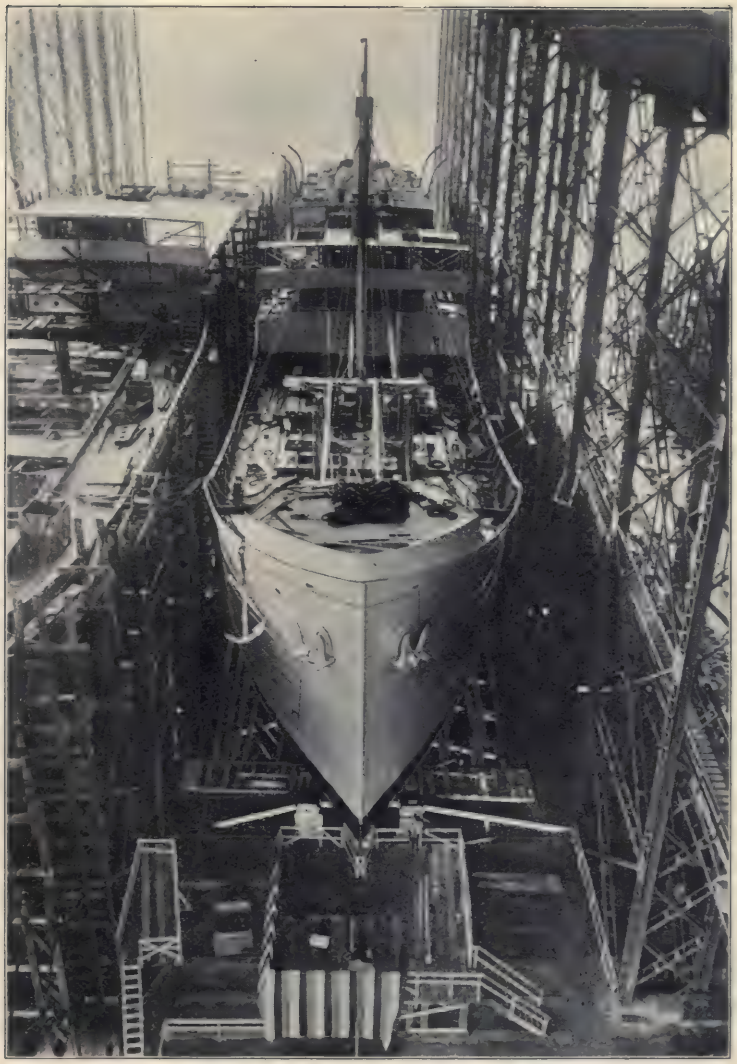


Courtesy of Providence Chamber of Commerce

FIG. 145. A steamship on ways ready for launching

SPEED OF SHIP CONSTRUCTION

The launching of the collier *Tuckahoe*, in April, 1918, set a world's record for speedy ship construction. Just 27 days, 2 hours, and 43 minutes after the work of laying the keel commenced the *Tuckahoe* slid into the water. Moreover, the ship was so nearly completed before leaving the ways that very little work remained to be done to fit it for service. The very rapid building of the collier was due to the fact that all parts of the ship were made in the steel factories exactly the right size and shape, just as the beams and joists are made



© Underwood & Underwood

FIG. 146. The collier *Tuckahoe*, built in twenty-seven days, makes a world record for speedy ship construction

for our large buildings, and needed only to be fitted together to complete the vessel. This modern method of ship construction is known as ship "fabrication."

ELECTRICALLY PROPELLED SHIPS

Further, many of the modern ships are being equipped with machinery which makes possible the propelling of the boat by electricity. Oil is burned to produce steam, and the steam runs the engine which generates the electricity to move the ship. This new machinery makes the running of the ship easier, cheaper, and more reliable. An electrically propelled ship can be run with 25 to 35 per cent less fuel than those having other types of engines.

WHERE SHIPS ARE BUILT

To-day shipyards are located at all the more important Atlantic-coast cities. The equipment for making some of the largest ships is at Quincy, Massachusetts, and Bath, Maine. New York and Hog Island, Philadelphia, are the greatest ship-manufacturing centers. By the shores of the Delaware and Chesapeake bays are other busy yards, located at Trenton, Camden, Wilmington, and Newport News. Both steel and wooden ships are built at the Pacific-coast ports of Seattle, San Francisco, and Los Angeles. The vessels for the Great Lakes traffic come from the cities on their southern shores, built in the yards of Cleveland, Chicago, Detroit, and Buffalo.

AUTOMOBILES

Rapid growth of the industry. One of the newest industries, and one of great importance, is our manufacture of automobiles. This industry has grown so rapidly that

in less than twenty years since it began in the United States this country has come to export more machines than all other countries together. More than 4,200,000 machines are running in the United States at present.

The great extent to which automobiles are made and used in this country today is shown by the scene on any of our city boulevards on a pleasant holiday afternoon. On the Yonkers road to New York, on Michigan Avenue, Chicago, or the Columbia Highway, Portland, the road for miles is filled with motor cars so closely jammed together that crossing the street seems hopeless. Six or eight abreast, headlight to tail-light, moving inch by inch, jealously snatching place from one another, slipping clutch, stalling, waiting, throwing again into first, the sluggish stream pours over the boulevard.

© Underwood & Underwood

FIG. 147. One of our newest iron, oil-burning battleships, U.S.S. *North Dakota*

AN ASSEMBLING INDUSTRY

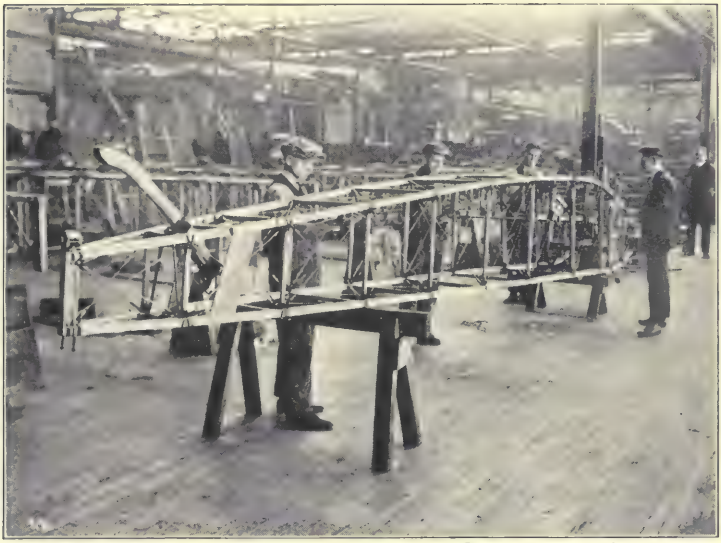
The automobile industry is interesting in that but few factories manufacture all the parts needed for the making of a complete machine. There are factories which

manufacture nothing but tires, others which make only ball bearings, and others which manufacture motors or the bodies of the cars. From these many factories the automobile maker assembles the different parts which he puts together to make his own brand of machine.

Detroit and Cleveland are the leading automobile centers, and there are also factories for the making of automobiles in and about many other large cities of the United States.

AËROPLANES

Spruce, linen, and steel for aëroplanes. The newest of all our manufacturing industries is the making of aëroplanes, which increased rapidly after 1917, owing to war demands. The problem for the maker of air machines is to combine in one plane great lightness, strength, and speed. Best suited for the framework of the machine is the strong, light wood of the Pacific-forest spruces. Only the most perfect trees and only the very best part of the wood of each tree can be used. The wings are made of strong linen stretched very tightly over spruce frames. They are painted with a cellulose mixture to shrink the cloth and make it taut and are varnished to make them waterproof. Women sew the linen cover of the wings into place by hand. Every stitch must be carefully taken, and every screw which holds the frame together must be fitted with the greatest care. The shape of the machine is planned to give it the greatest possible swiftness in flight, and no unnecessary material is added which could slow its speed. Fitted with a powerful steel motor and with propeller and controls, the aëroplane is ready for flight.



© Committee on Public Information

FIG. 148. The frame of an aëroplane being put together by skilled workers

FIG. 149. Aëroplane in flight over Newport News

Air routes. A well-marked air route has been laid out from Dayton, Ohio, to Rantoul, Illinois, for the training of airmen. The route is marked by huge numbers six to ten feet long and a yard wide painted on barn roofs at 2-mile intervals. Arrows are added pointing to a clear field where the plane may land if necessary. The air machine is the swiftest means of travel, flying from 100 to 150 miles an hour. Three routes are being established across the United States from the Atlantic to the Pacific, and mail is already being delivered by aëroplane.

GLASS

Sand for glass. The glass which makes our window-panes, mirrors, drinking-glasses, vases, and glass dishes is made from sand. This, with a flux, is heated to such a high temperature that it melts, forming a transparent liquid. The former method of making glassware was to dip a long tube into this hot liquid and blow thin bubbles of glass, just as you blow soap bubbles. The skillful glass-worker could so blow the bubbles as to form a vessel of any shape desired. Unless he blew quickly the glass cooled and hardened before the vessel was complete. To-day glass-blowing is done almost entirely by machinery. Southern New Jersey and southeastern Pennsylvania have become important centers for glassmaking because the coastal-plain sands of that region are fine and pure and the coal mines of the Appalachian mountain system are near at hand to supply the necessary fuel. Other centers of more recent development are in western Pennsylvania and in Ohio and Indiana. Either natural gas or coal-made gas is used for fuel for glassmaking.

Much of the finest glass for microscopes, telescopes, and other scientific instruments has been imported from Europe, but we are now making more and more very fine glass for these purposes in the United States.

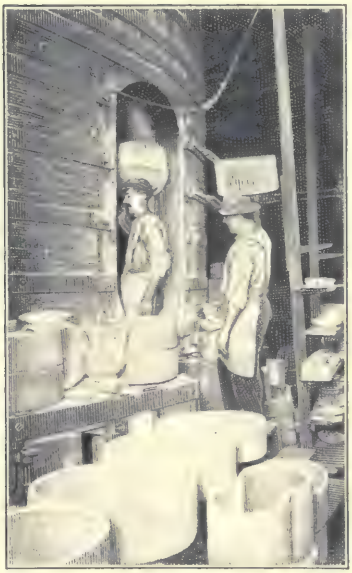
POTTERY

Clay for pottery. The clay of our clay soils is used for the making of porcelain and pottery. The clay is first moistened, then shaped in molds or by hand, and finally baked. Although clay soils are found in every state of the United States, fine grades of clay have long been imported from Europe. When after 1914 war made this importation impossible, there was a great shortage of clay for the making of the finer grades of pottery, for flower pots, and for lead-pencil manufacture. This shortage led to the discovery of deposits of plastic clay suitable for these uses, in Arkansas, Delaware, Illinois, and other states. It has been found also that various American clays can be mixed to produce a clay even better than those formerly imported. For the best *porcelains* we use clay from Alabama, Georgia, and the Carolinas.

The value of our pottery products has more than doubled in the last fifteen years. As we have produced more and better pottery we have depended less upon imported earthenware, and our factories now supply almost all our own needs as well as some ware for export. An interesting recent project of the pottery industry is the making of porcelain dolls and doll heads, which, before the war, had not been manufactured in this country.

The fuel necessary for pottery-making rather than the supply of clay determines the location of the industry.

At present the states of Ohio, Pennsylvania, and New Jersey are the leaders in the industry, but it may soon become increasingly important in the states which border the southern Appalachians, since they combine large deposits of the desirable clay and a large supply of coal from the southern Appalachian coal fields.



Courtesy of Alexis Everett Frye

FIG. 150. Dishes on the way to the kiln for baking

PAPER

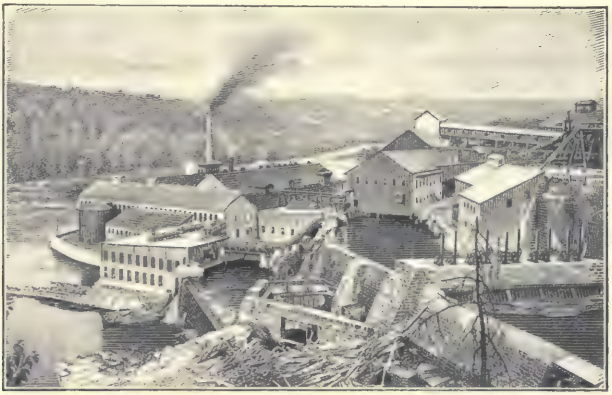
One of the most necessary and commonly used manufactured articles is paper. Everybody uses paper, — writing paper, book paper, wrapping paper, newspaper, — and the demand for it is very great. Paper has served as the means by which the ideas of great men who lived long ago can still be read to-day and by which people of one nation can know and understand the thoughts of other peoples.

MAKING PAPER FROM WOOD PULP

Paper-making is a very old art, but paper-manufacturing on the vast scale of the present day is new. Up to the year 1857 paper had always been made from rags of various fabrics — cotton, linen, and wool. At that time the discovery was made that paper could be made out of vegetable fibers of different kinds — straw, grass, and

wood. Since the Civil War the use of ground wood, or wood pulp, for paper-making has become very general in the United States.

Process. Spruce logs from our northern woods are stripped of their bark, ground by machines into bits, and the fine, ground pulp set afloat in great vats of water. From these vats an endless moving belt of wire gauze carries the pulp between hot steel rollers. As it moves

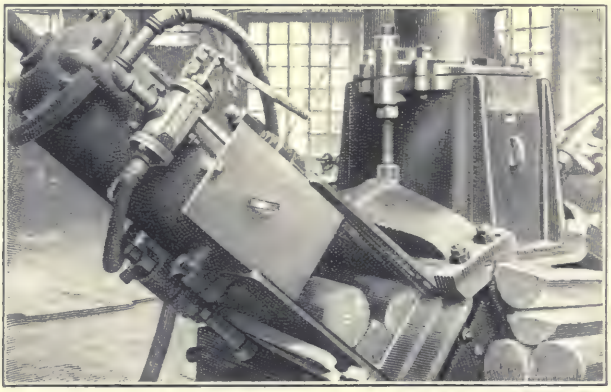


Courtesy of Alexis Everett Frye

FIG. 151. Mills for the making of paper

from roller to roller the water drains from the pulp, and the layer of fibers on the screen is dried and pressed into thinner and thinner sheets. As it comes from the last roller in sheets several yards across, it is wound on long spools, and the rolls sliced by circular saws into the lengths desired. For high-grade writing paper and book paper the spaces between the fibers are filled with a mixture of clay, resin, and talc to make the paper smooth. The great paper-manufacturing companies are also great lumbering companies, owning tracts of forest lands and cutting their own timber for pulp.

Where paper is made. The paper-manufacturing of the United States is centered chiefly in northern New England and northern New York. This is partly because the spruce, which furnishes a large proportion of the wood pulp used, is very plentiful in this part of the country (see Fig. 100). The grinding of wood into pulp requires a tremendous amount of force, and cheap water power is furnished by



Courtesy of Alexis Everett Frye

FIG. 152. Logs fed into the machine that will grind them to pulp

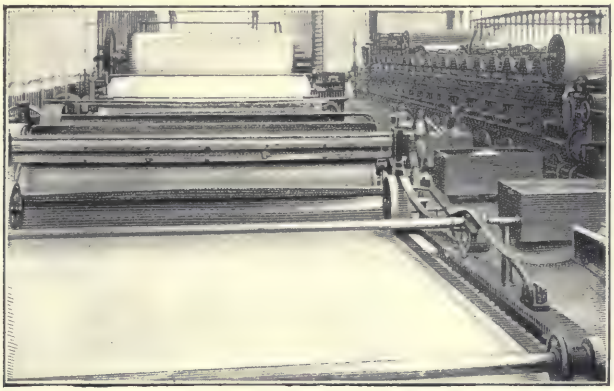
the waterfalls of these regions to turn the wheels of the mills. Moreover, the paper industry needs clear, pure water for soaking and bleaching purposes, and nowhere in the country is there such pure water as in this northeastern section.

As the spruces have been gradually cut off in New England and New York, it has been found that wood from other trees makes good paper pulp. Many of these varieties grow in the southern Appalachian region and on the north Pacific coast, and since there is also water power there, paper mills are being built in these regions.

As it becomes possible to use more and more kinds of wood for paper-making we may expect to see the industry grow in many parts of the United States.

SUBSTITUTES FOR WOOD PULP

The United States manufactures and uses more paper than any other country in the world — so much that our

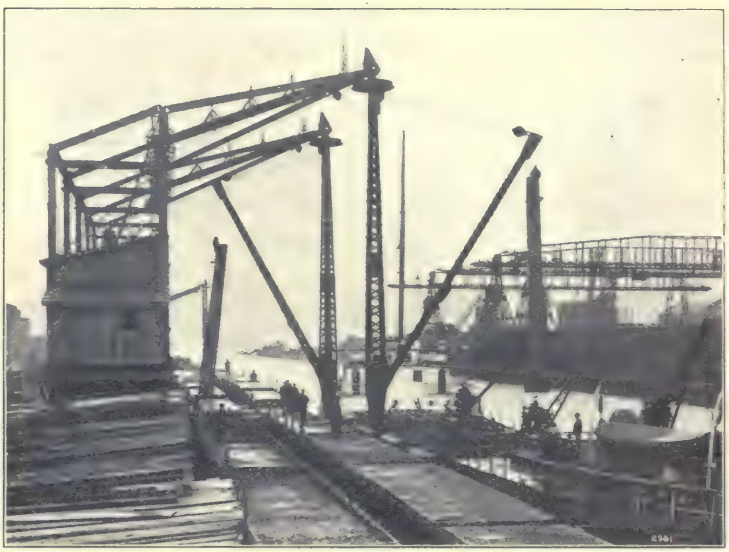


Courtesy of Alexis Everett Frye

FIG. 153. Wood fibers on the screen being pressed into paper

own supply of wood pulp is not equal to the demand and we are obliged to import it, especially from Canada and the Scandinavian peninsula. As the supply of wood for pulp becomes more scarce many substances may be used instead. Bamboo is one of the most promising substitutes. Five tons of bamboo fiber can be produced on one acre, and 45 per cent of it can be made into pulp. Paper can also be made from the fiber of the ground hull of the cotton seed and from the stalks of sugar cane after the juice has been pressed out. Other possible substitutes are cornstalks and flax straw.

These are only some of the most important of the manufacturing industries of the United States. Thousands of pounds of rubber are imported into this country each year and manufactured into rubber goods of every variety. Millions of dollars' worth of paints and varnishes



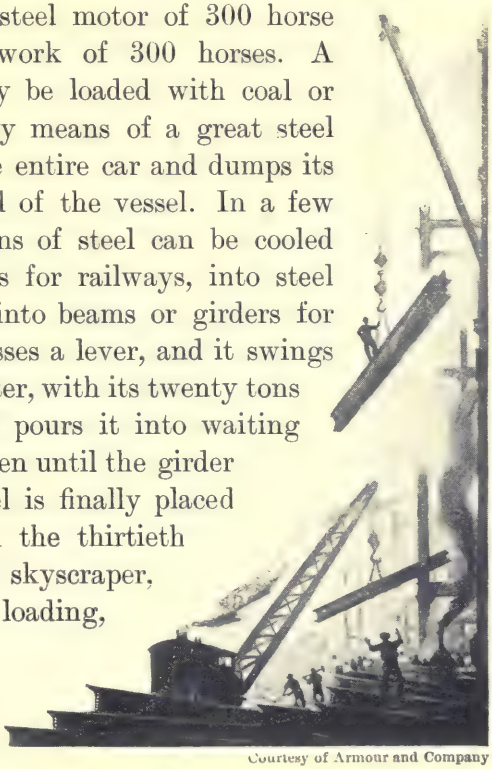
Courtesy of Lackawanna Steel Co.

FIG. 154. Cranes lifting rails into a steamer, Buffalo Harbor

and of chemicals are produced yearly. Printing and publishing are done in enormous quantities; there is scarcely a town in the United States which is without its printing press. There are also produced at wonderful speed by modern machinery an infinite variety of small articles, such as sewing needles, pins, watch springs, phonograph records, nails and screws, and tools of every kind.

Throughout all these industries we have seen how machinery made of iron and steel and run by coal or

by water power now does the work once done by man. One pound of coal can do as much work as a man can do in a day. One steel motor of 300 horse power can do the work of 300 horses. A 10,000 ton ship may be loaded with coal or ore in 35 minutes by means of a great steel crane which lifts the entire car and dumps its contents in the hold of the vessel. In a few hours a thousand tons of steel can be cooled and rolled into rails for railways, into steel plates for ships, or into beams or girders for buildings. Man presses a lever, and it swings the Bessemer converter, with its twenty tons of molten steel, and pours it into waiting cars below. From then until the girder made from this steel is finally placed by steel derricks on the thirtieth story of a New York skyscraper, the work of shaping, loading, carrying, and lifting is done largely by machinery.



Courtesy of Armour and Company

FIG. 155. Lifting a girder by a steel crane for the upper story of a skyscraper

It is our great wealth of natural resources — most important of all, our resources of coal and iron — which has made possible all these industries and many more and has made the United States the greatest manufacturing nation in the world.

CHAPTER X

OUR RESOURCES THE BASIS OF OUR TRADE RELATIONS

Problem. *How trade unites the nations of the world.*

The basis of trade. We have traveled from the miles of wheat fields of the fertile plains of the Northwest to the broad cotton plantations of the South, from the cotton mills of Massachusetts to the steel plants of Chicago. The Chicago worker in steel can no more live without the Western wheat which makes his bread than the Dakota farmer can plant and reap that wheat without machines made of Chicago steel. And the cotton manufacturer of Massachusetts is as dependent upon Southern cotton as the Texas planter upon cloth woven by New England's mills. Mountains and plains, warm lands and cold lands, poor soils and fertile soils, cannot but differ in the products they produce. Whenever two regions so differ, there exists the basis for trade between them. Each region grows or makes the thing it can make best and depends upon other lands for other products. Because of this there has always been and always will be *trade*.

INLAND COMMERCE

Transportation by water. In response to this need for trade have grown up all our means of transportation. The earliest trade routes were our waterways. In colonial

days, when there were no good wagon roads and railroads were unknown, the rivers of the Atlantic Plain were the routes of travel. The cities of the North and the plantations of the South grew up along the broad mouths of waterways as far inland as they could be reached by ocean-going ships. Then each plantation had its private

© Underwood & Underwood

FIG. 156. Coal barges blocked by ice in New York Harbor

pier, where several times each year a ship from England docked to take on the planter's tobacco and leave manufactured goods.

RIVERS AND CANALS AS TRADE ROUTES

From these earliest settlements near the river mouths the population spread very slowly westward. This was because the eastward-flowing rivers of the Atlantic coast

were navigable only short distances even for small craft. Falls in the river courses located at the border between the Piedmont plateau and the coastal plain prevented boats from passing many miles inland from the ocean. This, together with the difficulty of crossing the Appalachian mountain wall beyond, held the early settlers for

Fig. 157. Transportation on the Mississippi River

more than a hundred years to the narrow tidewater area along the coast from Maine to Georgia. Thus, as this land became more densely settled the people were bound together into a strong united group, ready to fight together for freedom as one nation.

Trade on the Mississippi. When settlement finally pushed beyond the Appalachians, the courses of westward-flowing rivers guided the moving tide of population. For

this interior country the Mississippi system with its many tributaries and its 14,000 miles of navigable water was the great trade outlet. Goods were early carried downstream on Mississippi flatboats from the settlements of the North to the Spanish towns of the South. The flatboats could not travel upstream and so were sold for lumber at New Orleans. By 1820 a thriving steamboat trade had grown up on the Mississippi and Ohio rivers, with important river ports at Pittsburgh, Cincinnati, St. Louis, and New Orleans.

Waterways joined by canals. But it was a long route from the northern interior states down the Mississippi to the Gulf and from there by sea to the cities situated along the Eastern coast. The need for water trade routes to the East led to the building, in 1825, of the Erie Canal from Buffalo to the Hudson River. This made a continuous water route from the Great Lakes to the Atlantic. The success of the Erie route caused the building within the next fifteen years of hundreds of miles of canals to join the natural waterways. With the Erie Canal also began the rapid growth of trade on the Great Lakes, which are unrivaled as the greatest inland waterway in the world.

GREAT LAKES COMMERCE

Though railroads are now used in place of many of our rivers and canals, our Great Lakes commerce grows larger every year. To-day the tonnage passing Detroit is as great as the combined foreign trade of New York, Liverpool, and London. Since the opening of the Soo Canal, in 1855, made possible the shipment of iron ore

from Lake Superior, ore has formed the chief single item of this trade. The iron-ore rates are the cheapest in the world — less than one tenth of a cent per ton per mile. Trains from south and west are steadily pouring iron ore, lumber, and grain into Duluth, Chicago, Milwaukee, Detroit, Cleveland, and Toledo. From these cities the products leave, shipload after shipload, for the East. Buffalo, at the eastern end of Lake Erie, is the chief center from which they are distributed to Eastern markets and to Atlantic seaports for shipment abroad. This movement of products eastward from Buffalo has become so great that the old Erie Canal could not handle the traffic, and it has recently been deepened and enlarged. It is now deep enough and wide enough to allow barges carrying 1000 tons of freight to pass through. One of the locks of the present canal is large enough to take the place of three of the old locks.

TRANSPORTATION BY RAIL

When, after 1826, railroads began to spread their network of steel rapidly from east to west, they followed the lines which the waterways had taken long before. The river valleys formed the lowest passes through the mountains, and the broad flat plains along their courses were the easiest highways to the West. The first two railroads across the Appalachians followed the same low Hudson-Mohawk pass which the builders of the Erie Canal had chosen for its course.

Railroads were built to connect the lake and river ports which had already become thriving cities in the days of steamboat trade. Thus St. Louis, which had

Courtesy of *Scientific American*

FIG. 158. Erie Canal, showing one lock of the new barge canal doing the work of three locks of the old canal

grown to be a commercial city near the junction of the Ohio, the Missouri, and the Mississippi rivers, soon became a railroad town as well. Twenty-four railroads now pass through it; and Kansas City, an early river port at a bend of the Missouri, is served by thirty-nine railroads. Chicago, the leading port on the Great Lakes, has become also the greatest railway center in the world.

Fig. 159. A crowded freight yard

In 1869 the Union Pacific Railroad crossed the continent and opened the way for the tide of population to pour westward. There are now across the United States five transcontinental lines which bind together the Atlantic and Pacific. The traffic of the Northwest is handled by the Northern Pacific and Great Northern roads from Duluth and Chicago to the ports on Puget Sound. The more southern trade moves from San Francisco and Los Angeles by way of the Union Pacific to Denver and Kansas

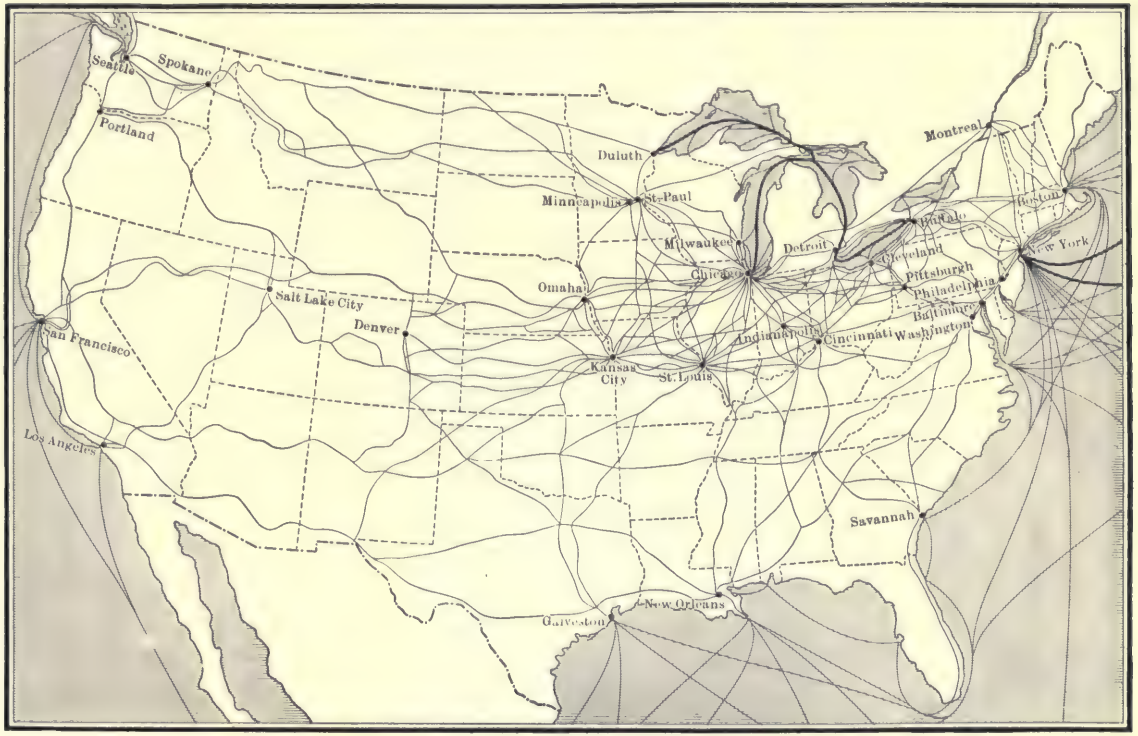


FIG. 160. Centers of transportation connected by through railroad lines

City, the Santa Fe route to Chicago, or the Southern Pacific to the Gulf. Trace these routes on Fig. 160.

Much of the traffic of these roads is between cities along the routes. But there is also much through movement of freight; California oranges and North Pacific lumber are in common use in the cities of the Eastern coast, and cotton from the Gulf States leaves for Eastern Asia from the ports on Puget Sound.

© Underwood & Underwood

FIG. 161. Ocean trade at the busy port of Copenhagen

Steam trains now deliver the mail which the fast-galloping horsemen of the Pony Express carried to the West in the first days of California gold; and the plains, which the ox-drawn prairie schooners of the first emigrants took three months to cross, are now crossed in three days.

OCEAN COMMERCE

In the days when the colonies were confined to the narrow belt east of the Appalachians, and the resources of the West and the South were unopened for their use, they were dependent upon foreign lands for many of their needs. New England was then the center of a

thriving ocean trade. Ships made of the New England white pine were the finest and fastest of their time. The famous clipper ships left New England eastward bound, with stores of lumber for English markets and fish for Spanish ports. They traded these products for food, cloth, and other manufactured goods at the European ports. From there they sailed south to the African coast, where they filled their ships with negro slaves. At the West Indies, on the home journey, some of the slaves were exchanged for cargoes of sugar and molasses, which they carried back to New England to be manufactured into rum.

Rapid growth of commerce. The day of clipper ships has passed, and wooden sailing vessels have given way to steam-driven ships of iron and steel. But the trade of the United States with other lands grows yearly, and this country is to-day the second commercial nation of the world. The value of our foreign trade in 1900 was seven times greater than in 1850, and that of 1916 three times as great as that of 1900. This shows how rapidly our production has increased, because in spite of the great growth of our population and the greater needs at home, we still have more and more to send abroad.

PRESENT AND FUTURE TRADE

Trade with Europe; exports. We have, from the first, carried on far more trade with Europe than with any other continent. England was well advanced in manufacturing when the United States became a nation. The countries of northwest Europe, with their many people and their small areas, needed from America the raw materials they had not room enough to grow at home as much

as our settlers needed the products of European mills. This trade was founded in the days when America depended on Europe for all her manufactured goods. It has continued to flourish, until to-day we send to European countries not only the raw cotton to supply their

© Keystone View Co.

FIG. 162. Marseilles, a thriving European port

mills, and grains and meat to feed their laborers, but also our machines and other manufactured goods of iron and steel. In 1850 three fifths of our exports were raw materials for manufacture, and 70 per cent of our imports were manufactured goods. Since then the nature of our trade has greatly changed. To-day, as our raw materials are used more and more by factories at home, three fifths of our exports and only one fifth of our imports are manufactured wares.

Future trade. Though Europe needs as much as ever the raw products of our forests and our fields, we need less and less the products of her mills. In recent years we have sold to the United Kingdom twice as much and to Germany four times as much as we have bought from them. As our manufactures continue to grow we shall have fewer raw products and more factory-made goods to sell. We are therefore likely in the future to trade more with those countries which have not so many factories at home. To-day only one tenth of our trade is with Asiatic lands and only 8 per cent with South America, while more than half is carried on with Europe. In the future our trade with Asia and South America is bound to grow and European trade relatively to lessen. The trade routes of the Pacific and the Panama route to western South America may then rival the routes of the North Atlantic, which is now the great commercial highway of the world.

© Underwood & Underwood

FIG. 163. Shipping at Montevideo, Uruguay, South America

Imports. To meet the needs of our growing manufacturing we must import some raw products. Hides and

skins from the great grazing lands of Argentina, Russia, and British India come to supply our leather industries, and wool from Argentina, Australia, and Uruguay helps feed our woolen mills. Cuba supplies the crude cane sugar for our refineries. These are all products which we

FIG. 164. A ship passing through the Panama Canal, towed by electric locomotives

produce at home, but of which we do not grow enough to supply our needs.

We must also import those materials which, because climate or other conditions are unsuitable, we do not produce at home. Rubber from the tropical forests of Africa and Brazil makes our raincoats, overshoes, and automobile tires, and raw silk from Japan and China our silk cloth. Brazil furnishes us seven tenths of our coffee. All these, with nitrates from Chili, cocoa from Brazil, wood and wood pulp from Canada, and manufactured products from Europe, have made up the larger part of our imports.

At all our great seaports we see the loading and unloading of these products as ships from other countries come and go. Stacked high on the wharves of Galveston are bales and bales of cotton, ready to be swung by strong steel cranes into steamers that wait beside

Courtesy of Armour and Company

FIG. 165. Loading freight for transportation

the docks. Along other piers — New York, New Orleans, Boston, Philadelphia, San Francisco, Savannah, and many more — we see crates, boxes, barrels, and bales laden with much merchandise from many different lands.

DEVELOPMENT OF PORTS

North Atlantic ports. These ports have grown up along our seacoasts where deep bays of quiet water give safe anchorage for ships. The ports which first developed

were those along our North Atlantic seaboard. Here the good harbors are many, and just opposite — across the narrowest portion of the Atlantic — are the ports of the great industrial nations of western Europe. The long succession of harbors from the fiords of Maine to Chesapeake Bay has been made possible by the sinking of this northern coast. As the land has sunk, the water of the sea has entered the mouths of the many rivers, making deep bays. Islands, separated from the coast by the sinking of the shore, protect the entrance to these harbors from stormy seas.

But great seaports do not develop wherever there are good harbors. Unless there are many products to be shipped to and from the region which these harbors serve, there can be no thriving ports. Our northeastern harbors are connected with the rich lands of the interior by the lowest and easiest of the passes over the Appalachian Mountains. These easy inland routes lead directly to the harbors, and over them have long been brought for shipment the many products of the fertile interior. From these harbors the westerly winds and the eastward-drifting waters of the northern Atlantic helped carry sailing vessels across the narrow ocean to European ports. The Northern forest supplied lumber for ships. The coarse glacial soils of New England discouraged farming so that the people turned of necessity to the building of ships and sea trade. Thus the colonists of New England became seafaring people, and great seaports developed along our coast from Portland to Baltimore.

New York. Of all these Northern ports New York has become by far the most important, while Boston has

© Underwood & Underwood

FIG. 166. Brooklyn Bridge and U.S.S. *Nevada*, New York Harbor

taken second place. New York alone handles about half of all our commerce. This city grew more rapidly than any other port, because of its excellent harbor and because it is located at the end of the easiest of all the inland routes, the one by way of the Mohawk gap across the

© Underwood & Underwood

FIG. 167. Barrels of sugar awaiting shipment on the sugar levee at New Orleans

Appalachians. It lies at the gateway to the West. By way of the Erie Canal and later railroads following this same Hudson-Mohawk route more Western products were brought to New York for shipment than to any other port. This has made the city not only our leading seaport but the foremost commercial city of the world. It is a great importing as well as a great exporting port.

Why there are few South-Atlantic ports. Along the Atlantic Coast south of Chesapeake Bay the rising of

the land has made the offshore waters shallow and left the harbors few. Long bars of sand which skirt the coast are barriers to ships. Here the fertile soils and mild climate yield abundant crops. Thus, in early days agriculture became the great industry of the South in place of the shipping and shipbuilding industries of the North, and there tobacco plantations developed rather than seaports. Moreover, this southern coast is cut off from the interior by the southern Appalachians, which are higher than the mountains to the north. There are fewer mountain passes; and transportation across them was in early days, and still is, difficult. Thus, products from the Southern interior find easier routes eastward by way of the Gulf ports to the south or by way of the Northern mountain passes to the coast which is nearest Europe.

Gulf ports. Thus the Gulf cities of New Orleans and Galveston have come to vie with Boston for second place among the ports of the United States. The former owe their importance to the great amounts of cotton and lumber they export, while Boston is a great importing center. The Gulf cities are the nearest of all the United States ports to the Panama route and the Pacific. As the Panama Canal becomes a great trade highway the importance of the Gulf ports is likely to increase. They will afford the easiest outlet for the products of the interior plains destined for our Pacific coast, for western South America, or for trans-Pacific countries.

Pacific ports. Since our trade has been so much greater with Europe than with Asia, the Pacific coast has had less importance commercially than the Atlantic. Moreover, the barrier formed by the Sierra Nevada and Cascade Mountains and the Rocky Mountain range — with a wide

stretch of arid plateau between — has separated this coast from the Mississippi Valley. This has left only a narrow belt of fertile country between the mountains and the sea to supply products for shipment from these Pacific ports. This coast was therefore late in developing commercially in spite of the excellent harbors of Puget Sound and San Francisco bay. The harbor of San Francisco is protected from the open ocean by a barrier of hills; the entrance

© R. J. Waters & Co.

FIG. 168. Ferry building and docks at San Francisco, our leading Pacific port

is by the Golden Gate — a narrow cleft in the rocky wall through which the early gold-seekers passed to the gold fields in the mountain valleys beyond. It is one of the deepest and most beautiful harbors in the world.

The importance of this and other Pacific ports promises to increase greatly in the future. As transportation by water is cheaper than by rail, much freight has been carried from the Pacific coast to the Atlantic coast, and to Europe, by way of Cape Horn. The opening of a short water route to the East by way of the Panama Canal will give greatly increased importance to this trade with

FIG. 169. Leading world-trade routes

Atlantic countries. Since the settlement and development of Alaska a thriving commerce has grown up between this territory and the ports on Puget Sound. Our island possessions — Hawaii and the Philippines — have opened new centers for Pacific trade. And as our dependence upon Europe lessens, these ports which face toward Asia — San Francisco, Los Angeles, Portland, and Seattle — are rapidly growing centers of our new trade with the Far East.

Map study. Trace on the world-commerce map three possible routes from New York to the Philippines. Which is shortest? How has this route been made possible? To what other important ports have the routes from New York been shortened by the opening of the Panama Canal? In what direction must one sail from New York to reach the Panama Canal? Which is nearer New York, Valparaiso or Buenos Aires? Which of all the ocean routes shown is the most traveled? Name the several important ports at each end of the North Atlantic route. If you should sail due east from New York what port would you reach? In what countries is United States cotton most used? (See Appendix.) Trace the routes by which Mississippi cotton is transported to these countries. Where does the United States obtain its wool supply? Trace the routes by which wool is brought from these regions to New England for manufacture. By what routes are coffee and rubber carried to the United States from South America? Trace the route by which silk is brought to the United States from China.

CONCLUSION

Just as to live man must have food, so a nation must have resources from which to get food, clothing, and shelter for its people. In the pioneer days of any country there are wide stretches of unsettled land for agriculture or broad pasture lands for grazing cattle. But as the population grows dense the fields are no longer

© Fred H. Kiser

FIG. 170. Glacier National Park, Montana. An area of lake, mountain, and forest set aside for the use of future generations

large enough to grow food for so many people, and in these crowded centers people turn to manufacturing. Factories, unlike farms, cover little land, and many products for man's use can thus be made in a small space. But the raw materials to be used in these factories can come only from our natural resources — the *lands*, *forests*, *minerals*, and *waters*. If there are not enough of these at home, then the nation must seek them elsewhere. In England a large manufacturing population lives on a very small area of land. But for the materials to manufacture she must depend upon the world outside — upon newer and less densely populated lands. Should this supply be cut off, the nation could not continue to exist.

The United States has now passed the pioneer stage. Already the densely settled areas of the East are manufacturing centers, and new centers grow steadily farther and farther to the West. The country is rich in natural resources, but our soils, forests, petroleum, coal, and iron are being used at an alarming rate. We depend more and more upon our commerce to bring to us from newer, more sparsely populated countries the materials we must have for life. This shows us that it is our duty to use our resources so as to do the greatest good to the greatest number of people. This can be best accomplished when all nations of the world conserve their resources for each other, to feed and clothe and house the people of the earth.

STATISTICAL APPENDIX

The statistics of manufactured products and of foreign commerce included in these tables have been condensed from the more complete statistics which appear in the following sources:

Abstract of the Census of Manufactures, 1914. United States Department of Commerce, Bureau of the Census

The Statistical Abstract of the United States (Annual). Bureau of Foreign and Domestic Science

Foreign Commerce and Navigation of the United States, 1916. Bureau of Foreign and Domestic Commerce

Yearbook of the Department of Agriculture, 1915 and 1916

Mineral Resources of the United States, 1915

ALL CROPS IN THE UNITED STATES

FIVE-YEAR AVERAGE OF TOTAL VALUE, 1911–1915: $6,060,202,043[1]

RANK 1911–1915 AVERAGE	CROP	VALUE[2] FIVE-YEAR AVERAGE	PERCENTAGE OF FIVE-YEAR AVERAGE	ACREAGE[2] FIVE-YEAR AVERAGE
1	Corn	$1,644,510,000	27.9	105,672,000
2	Hay	826,282,000	13.6	49,395,400
3	Cotton	728,222,000	12.0	35,132,200
4	Wheat	705,889,600	11.6	51,910,200
5	Oats	473,133,000	7.8	38,703,400
6	Potatoes	219,136,600	3.6	3,688,600
7	Apples	157,324,591	2.5	4,227,426[1]
8	Barley	114,389,000	1.8	7,473,800
9	Tobacco	101,889,200	1.6	1,209,800

[1] From "Yearbook of the Department of Agriculture," 1915.
[2] From "Yearbook of the Department of Agriculture," 1916.

MINERAL PRODUCTS AND LUMBER OF THE UNITED STATES

Product	Value	Value
	1914	*1915*
Total for all mineral production	$2,386,381,932	$2,114,730,333
Coal		
Bituminous	493,309,244	502,037,688
Pennsylvania anthracite	188,181,399	184,653,498
Iron		
Ore	71,905,079	101,288,984
Pig	298,777,429	401,409,604
Clay		
Products	164,986,983	163,120,232
Raw	3,765,568	3,971,941
Copper	152,968,000	242,902,000
Gold	94,531,800	101,035,700
Coke	88,334,217	105,503,868
Cement	80,533,203	75,155,102
Silver	40,067,700	37,397,300
Lead	39,998,000	47,660,000
Zinc	35,029,000	113,617,000
	1915	*1916*
Sawed lumber	$519,643,650.24	$609,847,085.32

VALUE OF MANUFACTURED PRODUCTS AND RANK BY STATES[1]

TOTAL VALUE OF ALL MANUFACTURED PRODUCTS FOR THE UNITED STATES IN 1914: $24,246,435,000

AGRICULTURAL IMPLEMENTS

Total for United States in 1914, $164,087,000

RANK	STATE	VALUE
1	Illinois	$65,338,000
2	Wisconsin	20,119,000
3	Ohio	17,485,000
4	New York	14,577,000
5	Indiana	12,791,000
6	Michigan	7,731,000
7	Iowa	5,216,000
8	Pennsylvania	4,844,000
9	Minnesota	3,813,000

BOOTS AND SHOES

Total for United States in 1914, $501,760,000

RANK	STATE	VALUE
1	Massachusetts	$200,530,000
2	New York	67,289,000
3	Missouri	40,311,000
4	New Hampshire	37,664,000
5	Ohio	32,774,000
6	Pennsylvania	27,845,000
7	Maine	22,836,000
8	Wisconsin	17,643,000
9	Illinois	16,892,000

AUTOMOBILES

Total for United States in 1914, $503,230,000

RANK	STATE	VALUE
1	Michigan	$326,749,000
2	Ohio	76,154,000
3	New York	24,676,000
4	Indiana	23,639,000
5	Wisconsin	14,152,000
6	Massachusetts	7,812,000

BRICK AND TILE, TERRA-COTTA, AND FIRE-CLAY PRODUCTS

Total for United States in 1914, $135,921,000

RANK	STATE	VALUE
1	Ohio	$23,376,000
2	Pennsylvania	22,731,000
3	Illinois	12,434,000
4	New Jersey	8,826,000
5	Indiana	7,218,000
6	Missouri	6,509,000
7	Iowa	6,400,000
8	New York	6,267,000
9	California	4,319,000
10	Michigan	2,474,000

[1] "Abstract of the Census of Manufactures, 1914," United States Department of Commerce, Bureau of the Census. Government Printing Office, Washington, 1917. Statistics are given only for the states which lead in production of each product.

BUTTER

Total for United States in 1914, $243,319,000

RANK	STATE	VALUE
1	Wisconsin	$34,076,000
2	Minnesota	33,294,000
3	Iowa	27,028,000
4	California	18,899,000
5	Ohio	14,939,000
6	Michigan	13,479,000
7	New York	12,427,000
8	Nebraska	11,082,000
9	Kansas	9,557,000
10	Pennsylvania . .	8,620,000

CANNING AND PRESERVING, FRUITS AND VEGETABLES

Total for United States in 1914, $149,176,000

RANK	STATE	VALUE
1	California	$54,425,000
2	Maryland	17,500,000
3	New York	14,858,000
4	New Jersey . . .	11,367,000
5	Indiana	8,376,000
6	Wisconsin	6,899,000
7	Ohio	4,730,000
8	Illinois	4,558,000
9	Michigan	4,422,000

CANNING AND PRESERVING, FISH

Total for United States in 1914, $31,111,000

RANK	STATE	VALUE
1	Maine	$7,656,000
2	Washington . . .	7,634,000
3	Massachusetts . .	5,798,000
4	Oregon	2,930,000
5	California	2,746,000
6	New York	1,411,000
7	Mississippi	1,315,000

CARRIAGES, WAGONS, AND REPAIRS

Total for United States in 1914, $106,697,000

RANK	STATE	VALUE
1	Indiana	$18,321,000
2	Illinois	13,773,000
3	Ohio	9,704,000
4	Pennsylvania . .	8,177,000
5	New York	7,618,000
6	Wisconsin	7,274,000
7	Missouri	5,714,000
8	Kentucky	3,558,000

CHEESE

Total for United States in 1914, $51,745,000

RANK	STATE	VALUE
1	Wisconsin	$28,076,000
2	New York	15,134,000
3	Michigan	2,031,000
4	Pennsylvania . .	1,497,000
5	Ohio	1,175,000
6	Oregon	907,000

CLOTHING (MEN'S)

Total for United States in 1914, $458,211,000

RANK	STATE	VALUE
1	New York	$197,369,000
2	Illinois	87,512,000
3	Maryland	29,000,000
4	Pennsylvania . .	28,033,000
5	Ohio	24,063,000
6	Massachusetts . .	16,218,000
7	Missouri	13,484,000
8	Wisconsin . . .	7,986,000
9	New Jersey . . .	5,954,000

CHEMICALS

Total for United States in 1914, $158,054,000

RANK	STATE	VALUE
1	New York	$42,877,000
2	New Jersey . . .	31,687,000
3	Pennsylvania . .	22,388,000
4	Michigan	13,891,000
5	Ohio	11,388,000
6	Illinois	8,618,000
7	Missouri	6,936,000
8	Massachusetts . .	6,685,000

CLOTHING (WOMEN'S)

Total for United States in 1914, $473,888,000

RANK	STATE	VALUE
1	New York	$345,316,000
2	Pennsylvania . .	37,059,000
3	Ohio	22,882,000
4	Illinois	20,751,000
5	Massachusetts . .	13,983,000
6	New Jersey . .	6,768,000
7	Maryland	6,015,000
8	Missouri	5,517,000
9	California	2,733,000

CONDENSED MILK AND MILK PRODUCTS OTHER THAN BUTTER AND CHEESE

Total for United States in 1914, $69,161,000

RANK	STATE	VALUE
1	New York	$15,702,000
2	Illinois	12,758,000
3	Wisconsin	10,707,000
4	Michigan	6,040,000
5	Pennsylvania	5,570,000
6	Ohio	3,212,000

FERTILIZERS

Total for United States in 1914, $153,196,000

RANK	STATE	VALUE
1	Georgia	$29,046,000
2	Maryland	13,987,000
3	South Carolina	13,825,000
4	Virginia	11,350,000
5	New Jersey	11,198,000
6	Alabama	10,870,000
7	North Carolina	10,308,000

COTTON GOODS

Total for United States in 1914, $676,569,000

RANK	STATE	VALUE
1	Massachusetts	$195,482,000
2	North Carolina	90,744,000
3	South Carolina	78,446,000
4	Georgia	59,982,000
5	Rhode Island	43,268,000
6	New Hampshire	35,680,000
7	Connecticut	30,191,000
8	Alabama	25,623,000
9	Pennsylvania	22,408,000
10	Maine	22,122,000
11	New Jersey	16,317,000
12	New York	15,671,000
13	Virginia	10,216,000

FLOUR-MILL AND GRIST-MILL PRODUCTS

Total for United States in 1914, $877,680,000

RANK	STATE	VALUE
1	Minnesota	$148,244,000
2	New York	77,409,000
3	Kansas	72,895,000
4	Illinois	49,493,000
5	Ohio	45,171,000
6	Pennsylvania	43,626,000
7	Missouri	38,686,000
8	Indiana	37,488,000
9	Texas	35,110,000

FOUNDRY AND MACHINE-SHOP PRODUCTS

Total for United States in 1914, $866,545,000

RANK	STATE	VALUE
1	Pennsylvania . .	$140,799,000
2	Ohio	122,817,000
3	New York	102,897,000
4	Illinois	95,368,000
5	Massachusetts . .	65,605,000
6	New Jersey . . .	41,870,000
7	Michigan	39,429,000
8	Wisconsin	37,200,000
9	Indiana	35,014,000
10	Connecticut . . .	24,558,000
11	California	17,478,000
12	Rhode Island . .	17,177,000
13	Missouri	14,564,000
14	Minnesota	10,549,000

GLASS

Total for United States in 1914, $123,085,000

RANK	STATE	VALUE
1	Pennsylvania . .	$39,798,000
2	Ohio	19,191,000
3	Indiana	14,881,000
4	West Virginia . .	14,631,000
5	Illinois	7,680,000
6	New Jersey . . .	7,598,000
7	New York	5,157,000

FURNITURE

Total for United States in 1914, $265,706,000

RANK	STATE	VALUE
1	New York	$48,139,000
2	Illinois	31,890,000
3	Michigan	30,185,000
4	Pennsylvania . .	24,147,000
5	Indiana	21,412,000
6	Wisconsin	20,774,000
7	Ohio	16,411,000
8	Massachusetts . .	13,827,000

HOSIERY AND KNIT GOODS

Total for United States in 1914, $258,913,000

RANK	STATE	VALUE
1	New York	$78,229,000
2	Pennsylvania . .	64,153,000
3	Massachusetts . .	17,419,000
4	Wisconsin	13,292,000
5	North Carolina .	8,892,000
6	Ohio	8,654,000
7	New Jersey . . .	7,850,000
8	Tennessee	7,523,000
9	Illinois	7,367,000

IRON AND STEEL, STEEL WORKS, AND ROLLING MILLS

Total for United States in 1914, $918,665,000

RANK	STATE	VALUE
1	Pennsylvania . .	$448,106,000
2	Ohio	205,023,000
3	Illinois.	64,995,000
4	Indiana	58,883,000
5	New York	32,078,000
6	West Virginia . .	21,186,000
7	Massachusetts . .	11,376,000
8	New Jersey . . .	10,420,000

PAINTS

Total for United States in 1914, $112,409,000

RANK	STATE	VALUE
1	New York	$22,426,000
2	Illinois.	19,043,000
3	Ohio	14,824,000
4	Pennsylvania . .	14,207,000
5	Michigan	6,110,000
6	Missouri	5,450,000
7	California	3,801,000

LEATHER

Total for United States in 1914, $367,202,000

RANK	STATE	VALUE
1	Pennsylvania . .	$85,253,000
2	Massachusetts . .	45,265,000
3	Wisconsin	42,204,000
4	New York	36,018,000
5	New Jersey . . .	31,652,000
6	Michigan	25,504,000
7	Illinois.	17,509,000
8	Ohio	11,628,000
9	West Virginia . .	11,015,000
10	California	10,021,000

PAPER AND WOOD PULP

Total for United States in 1914, $332,147,000

RANK	STATE	VALUE
1	New York	$56,336,000
2	Massachusetts . .	43,353,000
3	Maine	40,180,000
4	Wisconsin	31,205,000
5	Pennsylvania . .	25,439,000
6	Ohio	23,284,000
7	Michigan	22,050,000
8	New Hampshire .	17,708,000
9	New Jersey . . .	10,931,000

POTTERY

Total for United States in 1914, $36,943,000

RANK	STATE	VALUE
1	Ohio	$15,292,000
2	New Jersey	7,868,000
3	West Virginia	4,821,000
4	New York	1,954,000
5	Illinois	1,788,000
6	Pennsylvania	1,736,000
7	Indiana	1,312,000

RUBBER GOODS

Total for United States in 1914, $223,611,000

[Not elsewhere specified]

RANK	STATE	VALUE
1	Ohio	$109,659,000
2	New Jersey	25,458,000
3	Massachusetts	23,011,000
4	Pennsylvania	12,177,000
5	New York	10,228,000
6	Connecticut	10,188,000
7	Wisconsin	7,382,000
8	Indiana	6,333,000
9	Rhode Island	6,089,000

PRINTING AND PUBLISHING (BOOK AND JOB)

Total for United States in 1914, $307,331,000

RANK	STATE	VALUE
1	New York	$78,840,000
2	Illinois	54,626,000
3	Pennsylvania	25,286,000
4	Massachusetts	20,245,000
5	Ohio	19,915,000
6	California	9,885,000
7	Michigan	9,381,000
8	Minnesota	7,651,000

SILK GOODS, INCLUDING THROWN SILK

Total for United States in 1914, $254,011,000

RANK	STATE	VALUE
1	Pennsylvania	$86,939,000
2	New Jersey	75,706,000
3	Connecticut	30,592,000
4	New York	29,261,000
5	Massachusetts	10,677,000
6	Rhode Island	7,664,000

SLAUGHTERING AND MEAT-PACKING

Total for United States in 1914, $1,651,965,000

RANK	STATE	VALUE
1	Illinois	$485,362,000
2	Kansas	151,647,000
3	New York	144,236,000
4	Nebraska	104,503,000
5	Missouri	91,608,000
6	Iowa	74,172,000
7	Pennsylvania	65,191,000
8	Ohio	64,960,000
9	Texas	52,945,000
10	Massachusetts	51,725,000

VARNISHES

Total for United States in 1914, $33,215,000

RANK	STATE	VALUE
1	New York	$9,458,000
2	Illinois	5,446,000
3	New Jersey	5,233,000
4	Ohio	4,503,000
5	Pennsylvania	1,798,000
6	Massachusetts	1,544,000

WHEAT FLOUR AND GRIST-MILL PRODUCTS

Total for United States in 1914, $543,839,000

RANK	STATE	VALUE
1	Minnesota	$117,988,654
2	Kansas	56,514,000
3	New York	40,798,000
4	Illinois	32,000,000
5	Ohio	27,000,000
6	Missouri	25,673,000
7	Indiana	21,183,000
8	Texas	21,805,000
9	Pennsylvania	19,795,000

WOOLEN AND WORSTED GOODS

Total for United States in 1914, $379,484,000

RANK	STATE	VALUE
1	Massachusetts	$127,351,000
2	Pennsylvania	63,113,000
3	Rhode Island	60,889,000
4	New Jersey	35,739,000
5	Kentucky	17,531,000
6	Connecticut	16,578,000
7	New York	15,859,000
8	New Hampshire	15,039,000
9	Ohio	7,233,000
10	Vermont	4,635,000
11	Wisconsin	1,956,000
12	Oregon	1,702,000

FOREIGN COMMERCE OF THE UNITED STATES

United States — One of the Three Great Commercial Nations

Year	Country	Value of Trade in Billions of Dollars	
1913	United Kingdom	6.2	Value of trade of these three countries = about $\frac{3}{8}$ of total world trade
1913	Germany	4.9	
1913	United States	4.2	
1913	Total world commerce	40.4	

Rapid Growth of Commerce of the United States

Year	Value of Trade in Millions of Dollars	Increase
1850	308	
1900	2244	More than sevenfold

Increase since 1900

Year	Value of Trade in Millions of Dollars	Increase
1900	2244	
1914	4258	Nearly doubled
1916	6469	Nearly tripled

Change in Character of Trade

Exports[1]	1850	1900	1910	1916
	Per cent	*Per cent*	*Per cent*	*Per cent*
Crude materials for use in manufacturing	62.2	23.7	33.1	12.5
Manufactured products[2]	17.1	35.3	44.8	62.1

Imports[3]	1850	1900	1910	1916
	Per cent	*Per cent*	*Per cent*	*Per cent*
Crude materials for use in manufacturing	6.7	32.5	36.3	43.1
Manufactured products	70	39.6	41.9	30.4

[1] Note the *decreasing* per cent of crude materials exported for use in manufacturing and the *increasing* per cent of manufactured products exported.

[2] This does not include foodstuffs partly or wholly manufactured.

[3] Note that raw materials for use in manufacturing now make up a larger per cent of the total imports than formerly, and manufactured products a smaller per cent.

LEADING IMPORTS INTO THE UNITED STATES

1914: Total, $1,900,000,000				1916: Total, $2,197,000,000			
Rank	Articles	Millions of Dollars	Per Cent of Total Imports	Rank	Articles	Millions of Dollars	Per Cent of Total Imports
1	Hides and skins	120	6.3	1	Sugar (raw)	208	9.5
2	Coffee	110	6.0	2	Rubber (crude)	159	7
3	Sugar (raw)	101	5.3	3	Hides and skins	158	7
4	Silk (unmanufactured)	100	5.2	4	Wool (unmanufactured)	142	6.8
5	Chemicals, dyes, etc.	88	4	5	Silk (unmanufactured)	124	5.6
6	Manufactures of vegetable fibers	82	4	6	Coffee	115	5
7	Rubber (crude)	76	4	7	Chemicals	109	5
8	Cotton (manufactured)	70	3.5	8	Manufactures of vegetable fibers	68	3
9	Wood and its manufactures	62	3	9	Wood and its manufactures	64	3
10	Vegetable (fibers unmanufactured)	54	2.7	10	Vegetable fibers (unmanufactured)	59	2.7
11	Fruits and nuts	53	2.5	11	Copper	52	2.3
12	Wool (unmanufactured)	53	2.5	12	Tin	50	2.2

LEADING EXPORTS FROM THE UNITED STATES

1914: Total, $2,330,000,000				1916: Total, $4,272,000,000			
Rank	Articles	Millions of Dollars	Per cent of Total Exports	Rank	Articles	Millions of Dollars	Per cent of Total Exports
1	Cotton (raw)	610	26	1	Iron and steel manufactures	621	14.5
2	Iron and steel manufactures	251	11	2	Explosives	467	10.9
3	Breadstuffs, including wheat	165	7	3	Breadstuffs	436	10
4	Meat and dairy products, especially hog products . .	146	6	4	Cotton (raw)	374	8.7
5	Copper manufactures	146	6	5	Meat and dairy products . .	290	7
6	Petroleum products	145	6	6	Copper manufactures . . .	173	4
7	Wood and its manufactures	103	4.5	7	Automobiles and railroad cars	168	4
				8	Brass manufactures	164	4
				9	Petroleum products	160	3.8
				10	Leather manufactures . . .	146	3.5

LEADING ITEMS OF TRADE OF THE UNITED STATES WITH VARIOUS COUNTRIES IN 1914

Article	Value in Millions of Dollars	Exported to / Country / Imported from	Article	Value in Millions of Dollars
Total: $594,000,000		United Kingdom	Total: $293,000,000	
Cotton (raw)	226		Rubber (crude)	30
Meat and dairy products	62		Manufactures of vegetable fibers, burlap, and linen	29
Breadstuffs	44		Cotton manufactures	22
Petroleum products	25		Wool (raw)	18
Wood and its manufactures	25.8		Wool manufactures	14
Total: $345,000,000		Germany	Total: $90,000,000	
Cotton (raw)	181		Chemicals, dyes, etc.	22
Copper and its manufactures	46		Cotton manufactures	18
Meat and dairy products	20		Fertilizer	16
Breadstuffs	14		Iron and steel manufactures	12
			Hides	7
			Toys	7
			Gloves and glove leather	7
Total: $330,000,000		Canada	Total: $161,000,000	
Iron and steel	75		Wood and its manufactures	30
Coal and coke	50		Wood pulp	6
Wood and its manufactures	20		Paper	11
Fruits	10		Flaxseed	11
Petroleum products	10		Hides	8.5
Total: $160,000,000		France	Total: $142,000,000	
Cotton (raw)	74		Art works	22
Copper and its manufactures	25		Silk manufactures	19
Petroleum products	12		Cotton manufactures, incl. laces	15

Breadstuffs	5.5		Wines, etc.	7
Machines	5		Hides	6.5
Tobacco	5		Wool manufactures	5
			Pearls	4
			Diamonds	3
			Nuts	3.6
Total : $68,000,000		Cuba	Total : $131,000,000	
Iron and steel manufactures	12		Sugar (crude)	98
Meat and dairy products	10		Tobacco	20
Breadstuffs	7		Iron ore	4
Wood manufactures	4			
Boots and shoes	3.5			
Total : $51,000,000		Japan	Total : $107,000,000	
Cotton (raw)	24		Silk (raw)	71
Wheat and flour	7		Tea	7
Iron and steel manufactures	5			
Oil (illuminating)	5			
Total : $112,000,000		Netherlands	Total : $32,000,000	
Copper and its manufactures	26		Diamonds	7
Breadstuffs	25		Tobacco	7
Meat and dairy products	12		Hides	3.6
Petroleum products	11		Rice	2.2
Wood and its manufactures	6		Bulbs	2
Linseed-oil cake	4			
Total : $30,000,000		Brazil	Total : $101,000,000	
Iron and steel manufactures	8		Coffee	76
Petroleum products	5		India rubber	16
Wheat and flour	3.7		Hides	3.5
Electrical machinery	2		Cacao	2

FOREIGN TRADE OF THE UNITED STATES

Ports	Per Cent of Total		Per Cent of Imports		Per Cent of Exports	
	1913	1916	1913	1916	1913	1916
Atlantic-coast ports	65.3	71.2	75.9	71	54.7	70.1
Gulf-coast ports	13.8	9.1	5.7	5	22.0	11.2
Pacific-coast ports	6.5	8.4	7.1	11.9	5.9	6.3

(The remaining 14 per cent is made up of land traffic to Canada and small amounts to Mexico.)

INDEX

Aëroplane, 190–192; frames of spruce, 190; mail, 192; routes in United States, 192; wings of linen, 190
Africa, rubber, 212; slaves, 209
Alabama, coal, 114; cotton, 111, 113–115; granite, 136; marble, 137; Muscle Shoals, 29; peaches, 65; porcelain clays, 193; rice on reclaimed wet lands, 50; Sheffield, 29; truck gardens, 74
Alaska, salmon fisheries, 94; trade route to Puget Sound, 220
Alfalfa, in crop rotation, 29–30; honey from, 61; on irrigated lands, 14, 19; for sheep, 86
Aluminum as substitute for copper, iron, and silver, 181–182
Anaconda, copper, 180
Animal products, 76–91; exports, 88, 210; meat, 76–84; meat replaced by nuts, 71; skins for clothing, 100–108. *See* Cattle, Hogs, Sheep
Anthracite. *See* Coal
Appalachians, as barrier, 202, 217; Birmingham steel center, 178; clay in southern section, 194; coal, 145; first railroads, 204; forests, 103, 121; granite, 136; iron ore, 173; limestone, 177, 178; oil field, 159–160; oil production, 162; paper mills, 196; passes over, 214, 216, 217
Apples, 63, 64, 70, 89
Argentine Republic, flax, 118
Arizona, adobe houses, 134; Bisbee and Clifton copper, 180; cliff dwellers, 119; dates, 65; Egyptian cotton, 112; honey and alfalfa, 61
Arkansas, cotton, 111; plastic clays discovered, 193; red gum, 134
Arrowrock Dam, 14
Assuan Dam, 20
Atlantic coast, fisheries, 91–93, 95–97; oyster canning, 97; peat in salt marshes, 155
Atlantic ports, origin, 213, 214; scarcity of Southern, 216–217; shipment of wheat, 42
Australia, wood resource, 125; wool, 107
Austria-Hungary, wood resource, 125
Automobiles, 188–190; an assembling industry, 189; centers of manufacture, 189; exports, 189; rapid growth of industry, 188

Baltimore, port, 214
Bangor, lumber, 122
Barley, 51, 89
Bath (Maine), shipbuilding, 188
Beef. *See* Cattle
Berries, 69
Birds, protection of crops and trees, 75, 76
Birmingham, steel-manufacturing center, 178 (map)
Bisbee, copper, 180
Bituminous. *See* Coal
Boise Project, 14, 66
Boll weevil. *See* Cotton
Boots and shoes, 102–103; history of making, 103
Boston, fish industry, 97; granite shipped to, 136; port, 213, 214, 216, 217
Brazil, cocoa, 212; coffee, 212; iron resources compared with United States, 172; rubber, 212
Brick, in Arizona, 134; in Assyria and Babylonia, 134; in California, 134; from clay, 134–136, 140; in Colorado, 134; imported from England, 134; making, 135; in New Mexico, 134
Brockton, shoe-manufacturing, 103
Buckwheat, 51
Buenos Aires, port, 220
Buffalo, 168; Great Lakes trade, 204; iron smelting, 174; shipbuilding, 188
Bureau of Fisheries, 98
Butte, copper mined and smelted, 179–180
Butter, production in Wisconsin, 83, 84; substitute for, 71

California, adobe houses, 134; barley, 50; beet sugar, 58; canning and drying of fruits, 69, 70; forests, 130; frost, 1913, 66; gold, 208; honey and alfalfa, 61; natural gas, 166;

occurrence of oil, 159, 160; oranges, 66, 89, 208; peaches, 65, 68, 70, 89; product map, 89; production of oil, 162; prunes, 70; raisins, 63, 70; rice, 49, 50, 89; Searles Lake potassium, 28; sheep, 85; vegetables, 74; walnuts, 70
Camden (N. J.), shipbuilding, 188
Canada, wood and wood pulp, 212; wood resource, 125
Canals, connecting water routes, 203; Erie Canal, 203, 204, 216; Panama Canal, 211, 217, 218, 219, 220; routes by, 201–203; tonnage through Soo Canal, 174, 203–204
Canning, of fruits and vegetables, 69, 70; of oysters, 97; of salmon, 94
Cascade Mountains, forests, 121
Caspian oil, 158–159
Cattle, 78–84; beef cattle on ranches, 78; conserving all the animal, 82; in the corn belt, 47; cottonseed meal for, 116; dairy in New England, 83; drying, salting, and smoking of meat, 82; fattening, 81; on the free range, 79; frontier industry, 100, 102; hides for boots and shoes, 102–103; meat inspection, 82; meat-packing centers, 81, 82; reasons for location of dairy, 83; round-up, 79, 80; staple foods, 81, 115, 118; value of dairy products, 84; value and numbers, 78
Charcoal. *See* Wood
Cheese, food value, 84; substitute for, 71; Wisconsin production, 83, 84
Chesapeake Bay, ports, 214; shipbuilding, 188
Chicago, iron smelting, 174, 175, 200; leading Great Lakes port, 204; lumber trade, 123; meat-packing center, 81; production center of agricultural machinery, 182, 200; railway center, 206, 208; shipbuilding, 188
Chile, nitrates, 212
China, 108; iron resource compared with United States, 172; wood resource, 125
Cincinnati, river port, 203
Clay, for brick, 134–136; filler for writing paper, 194; for porcelain, 193; for pottery, 193; in soil, 6; superiority of American, 193
Cleveland, Great Lakes shipping port, 189, 204; iron smelting, 174; leading automobile center, 189; shipbuilding, 188
Clothing, 2, 100–118; cotton, 108–117; leather, 100–104; linen, 117–118; wool, 104–108
Clover, in crop rotation, 29; honey from, 61; for sheep, 87
Coal, briquettes, 151; burning in mines, 149, 150; by-products, 152, 153; coke, 151; distribution, 144 (map); for electricity, 168; formation, 143, 144; as fuel, 141, 142; gases in mines, 149; kinds, 144, 145; leading states in production, 145; mines flooded, 149; mining, 146–151; for motive power, 142–143, 198–199; need for conservation, 154; saving soot, 153–154; sorting, 150; substitute for, *see* Water power
Cocoa from Brazil, 212
Coffee, from Brazil, 212; transportation route, 220
Coke, use in smelting iron, 175. *See also* Coal
Colorado, adobe houses, 134; alfalfa and honey, 61; beet sugar, 58; cliff dwellers, 119; coal, 145; marble, 137; oil, 159, 160; sheep, 85
Commerce. *See* Trade
Concrete, 138–139; reënforced, 139
Connecticut, glacial lakes, 23; sandstone, 137
Connellsville (Pa.), coke, 151, 177
Copper, aluminum substitute for, 181, 182; in Arizona, 180; future supply, 181; in Michigan, 179; in Montana, 179–180; uses, 179, 180
Corn, 43–48, 89; conservation, 47; cultivation, 46; on drained lands, 26; early history, 43; harvesting, 46; husking, 46; planting, 45; questions on location of corn belt, 44; regions of production, 45; requirements, 43, 44; for sheep, 87; size and importance of crop, 44; soil and climatic requirements, 43, 44; stalks for wood pulp, 197; storage, 47, 48; uses, 46–48
Corn belt, 43–44; map, 45
Cotton, 89, 109–117; climate for, 110–111; clothing, 2, 115; on drained lands, 26; Egyptian variety, 20, 112–113; exports of, to Europe, 116, 210; growth, 113; on irrigated lands, 112; leading producing states, 111; manufacture, location of, 113, 115; paper, 194; production, moving westward, 111; sea-island variety, 113; seed, 116; shipping ports, 116;

in Southern states, 109–116; transport of, 220; use, 109, 115–116; varying cost, 109; yield of, on rich soils, 111
Cotton belt, 111–112, 116
Cotton-boll weevil, 116, 117
Cotton fiber, 109, 112, 113, 115, 117
Cotton gin, 110, 118
Cotton meal for cattle, 116
Cotton thread, 109
Cottonseed hull, substitute for wood pulp, 197
Cottonseed oil, 115, 116
Cranberries, 24
Creosoting wood, 127–129
Crop rotation, soils made poor by one-crop farming, 26, 27; use of nitrogen for plants, 29, 30
Cuba, crude sugar cane, 212; sugar, 53

Dairy products, 82–84, 89; in Northeastern states, 82, 83; states leading in production, 83. *See* Cattle
Dayton (Ohio), air route from, 192
Delaware, manufacturing, 107; shipbuilding, 188; truck gardens, 73
Delaware Bay, plastic clays, 193; shipbuilding, 188
Denmark, exports to, 118
Denver, railroad center, 206
Department of Agriculture, United States, fighting boll-weevil, 116, 117; meat inspection, 82; wool-raising, 107
Detroit, lake tonnage, 203, 204; leading automobile center, 190; shipbuilding, 188
Drainage. *See* Wet lands
Duluth, Great Lakes shipping, 204; iron-ore shipping center, 174; railroad center, 206; steel-making, 177

Electricity, in connection with irrigation projects, 17, 19, 20; for heat, 168; for light, 168, 169; as motive power, 169; use in manufacture, 114, 169. *See also* Water power
England, bricks from, 134; exports to, 110, 118
Europe, export of cotton and cottonseed oil to, 116; export of wheat and flour to, 42; manufactured goods, 209
Everglades, Florida, 22

Fall River, 114
Farm machinery in wheat region, 37, 38, 39; manufacture, 182–183
Fertilizers, definition, 27; kinds, 27; nitrogen from coal, 152; sources, 27–29, 116
Fisheries, 91–99; Atlantic, 91, 92; Bureau of, 98, 99; colonial industry, 91; deep-water fishing, 92, 93; drying and salting of cod, 95; government protection of fish, 98, 99; Great Lakes, 94; Gulf of Mexico, 92, 96; Pacific-coast salmon, 94; preserving fish, 91, 94–95; shellfish, 92, 96–97; value of cod, 95; value of salmon, 94
Flax, 117–118; in Argentina, 118; fiber of, for linen, 117; grown for seed in United States, 118; in Russia, 118; straw substitute for wood pulp, 197; uses of seed, 118
Florida, cotton, 113; grapefruit, 89; oranges, 63, 66, 89; peat, 155; pecans, 71; strawberries, 68; truck gardens, 74
Flour. *See* Wheat
Food, 1; soils, principal source, 33–90; waters as a source, 90–99
Forest service, turpentine production, 130; United States, 127
Forests, 89, 121–134, 140; conservation methods of cutting, 127; conserving wood, 125, 130; consumption of lumber, 124, 125; decreasing supply, 124, 125; destruction by sulphur fumes, 180; evergreens, 121; forest belts, 121, 122; forest fires, prevention of, 125–127; forest regions, 121–124, 122 (map); hard woods, 121; logging, 131, 132; lumber industry in New England, 121, 122; marketing logs, 132, 133; original extent of forests, 121; preventing wood from decay, 127–128; sawmill industry, 133; shifting centers of lumber supply, 121–124; turpentine from pine trees, 129, 130; uses of lumber, 124; waste of hardwood forests, 123. *See also* Paper, Aëroplanes, Ships
Fort Worth, meat-packing center, 81
France, silk fiber, 108
Fruits, 63–71, 89; canning and drying, 69, 70; on drained lands, 26; enlarging fruit lands, 65; exports, 71; on irrigated land, 19; nuts, 71; our fruit lands, 64; protection against frost, 66–67; transportation, 68; value of crop, 63; widespread production, 64
Fuel. *See* Coal, Gas, Petroleum, Wood

Galveston, 116; cotton port, 216; seaport, 217
Gary, iron smelting, 174
Gas, natural, as fuel, 141, 165, 166; glass-making fuel, 192; substitute, *see* Water power; waste, 165, 166
Georgia, cotton, 89, 111, 113–115; hogs, 87, 88; marble, 137; peaches, 64, 65, 89; porcelain clays, 193; rice, 49, 89; slate, 137; tide-water area, 202; truck gardens, 74
Germany, 211; potassium, 28; rye, 51
Glacier-laid soil, 31–32; map, 30–31
Glass, 192–193; manufacture, 192; sand for, 192
Glove-making, 102, 103, 104
Gloversville (N.Y.), 103
Goatskins, 102, 103, 104
Grain elevators, 39, 40
Grains, 33–51; for cattle, 47, 48; for hogs, 47; for horses, 51; for sheep, 47, 86
Grapefruit, 64, 89
Grapes, 64, 89
Great Britain, cotton manufacture, 115
Great Lakes, fisheries, 94; lumber, 123; ore movement, 173–175; shipbuilding, 188; trade, 203, 204; vineyards, 63, 64
Gulf Coast fisheries, 92, 96
Gulf ports, 42, 217; export cotton and lumber, 217; export wheat, 42; ship to Panama Canal, 217

Hawaii, sugar from, 53; trade with, 220
Hay, 19, 89, 115; on irrigated lands, 19
Hemlock used for tanning, 102, 103
Hemp, 118
Hides and skins, from Argentina, Russia, British India, 212; for leather, 100–104; for shelter, 119
Hog Island (Philadelphia), shipbuilding, 188
Hogs, 87–88, 89; in the corn belt, 47, 87; in our export trade, 88, 210; pig clubs, 86, 88; producing region, 87, 88, 89; as source of food, 87
Holland, exports to, 118, 237
Honey, early source of sugar, 53; production of, 61
Hood River Valley, apples, 63
Horses, hides of, for boots, 102
Houses. *See* Wood, Steel, Brick, Stone
Hudson-Mohawk Pass, 204, 216
Hydroelectric power, in connection with irrigation projects, 17, 19, 20; making of, 168. *See* Water power

Idaho, beet sugar, 58; honey and alfalfa, 61; sheep, 85, 105
Illinois, coal, 145; corn, 44, 45; hogs, 87–89; natural gas, 166; oil, 159–160; plastic clays, 193; wheat, 35
India, wood resource, 125
Indiana, coal, 145; corn, 44, 45; hemp, 118; hogs, 87, 89; limestone, 137; natural gas, 165; oak, 134; oil, 159, 160; wheat, 35
Insect pests, protection of soil products against, 74–76
Iowa, corn, 44, 45; hay, 89; hogs, 87, 88, 89
Iron and steel, 170–178; aluminum substitute for, 181; Bessemer process, 177; early Roman smelting, 175; essential for all industry, 170–172; Lake Superior iron ore, 172, 173; making steel, 176, 177; mining ore, 173, 174; open-hearth process, 177; ore movement on Great Lakes, 173 (map), 174, 175; pig iron, 175; Pittsburgh manufacture, 151; reusing iron, 178; smelting, 174–176; sources, 170; steel cranes, 198–199, 213; steel-making cities, 177; transportation rates, 203, 204; uses of, in construction, 139, 140, 182–190; wrought iron, 175
Irrigation, advantages, 14, 15; area which can be reclaimed, 13, 14; crop yields increased, 19, 21; definition, 13; early, by Mormons in Utah, 13; fruit lands enlarged, 65; government projects, 15, 16; power development in connection with, 17, 19, 20; protection against frost, 67; Salt River Project, 20; Strawberry Valley Project, 16–21
Italy, silk fiber, 108

Japan, export of wheat and flour to, 41; silk fiber, 108
Johnstown (N. Y.), 103

Kangaroo hides for boots, 102
Kansas, corn, 45; hog-raising, 87, 88; natural gas, 165–166; occurrence of oil, 159–160; production of oil, 162; wheat, 35
Kansas City, meat-packing center, 81; railroad center, 206
Kentucky, coal, 145; corn, 45; hemp, 118; limestone, 137; oil, 160; tobacco, 89
Kerosene. *See* Petroleum

Lake Superior, copper, 179–180; iron ore, 173, 175, 177. *See* Great Lakes
Lamb, 54, 87. *See* Sheep
Leather, 100–104; from Australia and Argentina, 102; for clothing, 2; for gloves, 103–104; from India and China, 103; prices, 104; product of frontier, 100–102; for shoes, 103; tanning, 102, 103; uses, 100–104
Lemons, 64, 89
Lignite. *See* Coal
Linen, for aëroplanes, 190; manufacture, 117, 118; in paper-making, 194
Loam, 8
Los Angeles (Cal.), railroad center, 206; shipbuilding, 188; trade with Far East, 220
Louisiana, corn, 26; cotton, 111; cypress, 134; oil, 159–160; rice, 49, 50, 89; sugar cane, 54, 89; swamp lands, 22, 26, 54; truck gardens, 74
Lumber industry. *See* Forests
Lynn (Mass.), 103

Machinery, 182–183, 198, 199
Maine, granite, 136; hemlock, 134; logging, 121–122; ports, 214; potatoes, 35, 89; shipbuilding, 188; slate, 137; spruce, 134; tidewater area, 202; value of fuels, 142; wheat, 35
Malaria, 24
Manufactures, aëroplanes, 190–192; aluminum, 181–182; artificial stone, 138, 139; automobiles, 188–190; boots and shoes, 103; bricks, 134, 135; briquettes, 151; coal by-products, 152, 153; coke, 151; copper, 179; cotton, 110, 113–116; electricity in manufacture, 114, 169; fertilizers, 27–29, 116; flour, 40, 41; glass, 192, 193; gloves, 103, 104; iron and steel essential for all, 170–172; linen, 117, 118; machinery for agriculture, 182, 183; paper, 194–197; pottery, 193–194; rails, cars, locomotives, 183–185; ships, 185–188; steel, 151, 175–178; woolen goods, 104, 106, 107
Maple sugar, sap, 60; sirup, 61
Marshes, 22, 23. *See* Wet lands
Maryland, shipbuilding, 188; truck gardens, 73, 89
Massachusetts, codfish, 95; cotton manufacture, 115; granite, 136; logging, 121, 122; sandstone, 137; shoes, 103; woolen cloth, 107. *See* New England
Memphis, 116
Mesabi, iron ore, 173, 175
Metals, aluminum, 181–182; copper, 179–181; iron and steel, 170–178; other metals, 182
Mexico, 116; wood resource, 125
Michigan, beet sugar, 58; frost 1906, 65; fruits, 89; Keeweenaw Point copper, 179; lumber, 123; potassium, 28; sheep, 86
Milk, food value, 84; New York, 83, 84
Milwaukee, 204; barley, 51; flour, 41
Mineral plant foods, 26–31; kinds, 27; maintenance of, in soils, 27, 28, 29; waste of, by one-crop farming, 26
Mineral resources. *See* Clay, Stone, Coal, Peat, Petroleum, Gas, Iron, Copper, Aluminum, Glass, Pottery
Minneapolis, flour-milling center, 40, 41
Minnesota, barley, 89; iron map, 173; rye, 89; wheat, 35–37
Mississippi, cotton, 111; cotton transported, 220; peat, 155; rice, 50
Mississippi River, trade on, 203
Missouri, apples, 89; corn, 45; hogs, 87, 88
Mobile, 116
Montana, Anaconda copper, 180; Butte copper, 179–180; coal, 145; oil, 159–160; sheep, 85, 105; wheat, 35
Mosquitoes, 24
Mutton, 84–87. *See* Sheep

Natural resources, definition, 4; vital importance, 221–222
Nebraska, corn, 45; hogs, 87, 88, 89; potassium, 28; wheat, 35
New Bedford, cotton manufacture, 114
New England, center of colonial ocean trade, 208; cleaning, scouring, and bleaching wool, 106; corn-growing, 44; cotton manufacture, 113–115; dairy products, 82, 83; early shipbuilding, 185; early wheat-raising, 33; fish for Spain, 209; fisheries, 91–93, 95, 96, 97; glacial soils, 32, 30–31 (map), 214; houses, 134; lumber, 121, 122, 214; lumber for England, 209; manufacturing, 107; paper, 196; poultry, 88, 90; pure waters, 106; rum, 209; sheep, 85, 86; shoe-manufacturing center, 103
New Hampshire, logging, 121, 122
New Jersey, pottery, 194; sandstone, 137; shipbuilding, 188; silk, 108; truck gardens, 73, 89

New Mexico, adobe houses, 134; honey and alfalfa, 61; sheep, 85, 105
New Orleans, 116; relation to river trade, 203; river port, 203; seaport, 213, 217
Newport News (Va.), shipbuilding, 188
New York, buckwheat, 51; dairy products, 83, 84; flour, 41; fruits, 89; gloves, 103; hay, 89; lumber, 123; maple sugar, 60; Niagara Falls, 29; paper, 196; sandstone, 137; sheep, 85, 86; ship-manufacturing center, 188; silk, 108
New York City, average food supply per week, 99; port, 213, 214–216, 220
Nitrogen, from air, 29; Chile nitrates, 29, 212; from coal, 152; in cotton meal, 116; nitrogen-fixing bacteria, 29, 30; as plant food, 27
North Carolina, cotton, 111, 113–115; grapes, 64; peat of Dismal Swamp, 155; pitch, tar, turpentine, 129; porcelain clays, 193; tobacco, 89; truck gardens, 74
North Dakota, barley, 51; coal, 145; wheat, 35, 36, 37, 200
Norway, wood resource, 125
Nuts, 71

Oats, 51, 89; for sheep, 87
Ohio, beet sugar, 58; coal, 145; corn, 44, 45; fruits, 89; hogs, 87, 88, 89; natural gas, 141, 165; oil, 159, 160; pottery, 194; sandstone, 137; sheep, 85, 87, 105; wheat, 35
Oil, cottonseed, 115; linseed, 118; whale, 156. *See also* Petroleum
Oklahoma, coal map, 144; cotton, 111; occurrence of oil, 159–160; production of oil, 162; wheat, 35
Omaha, meat-packing center, 81
Oranges, 64, 89
Oregon, apples, 63, 89; Douglas fir, 130, 131, 134; forests, 130; irrigation, 16 (map); sheep, 85

Pacific coast, fisheries, 94; forests, 121, 124; lumber, 208; oil, 141; paper mills, 196; shipbuilding, 188
Pacific ports, late development, 218; opposite Asia, 217; Rocky Mountain barrier, 217, 218
Paints and varnishes, 198
Panama Canal, trade through, 211, 217–220
Paper, 194–197; location of manufacture, 196; materials of manufacture, 194, 195
Paterson (N.J.), 108
Peaches, dried, 70; production, 19, 64, 65, 68, 70, 89; transportation, 68
Peat, formation, 154; as fuel, 154–155; future value, 155; nature of bog, 23
Pennsylvania, buckwheat, 51; coal, 142, 144, 145; coke, 151; dairy products, 83; hay, 89; lumber industry, 123; maple sugar, 60; natural gas, 165; oil, 159, 160; pottery, 194; sheep, 85, 86, 105; Titusville oil, 159
Peoria (Ill.), farm machinery, 182
Petroleum, 141, 156–165; conservation, 163–165; discovery and early use, 156–157; distribution, 159 (map); formation, 157; as fuel, 141, 161–162; gasoline, 162; gushers, 160; increase in production, 162; kerosene, 156, 157; locating and drilling for, 157–160; for motive power, 161, 163; pipe lines, 160–161; producing regions, 159–160; refined products, 162; in Russia, 158, 159; for ships, 165, 188; substitute for, 166–169
Philadelphia, locomotives, 183; seaport, 213; shipbuilding, 188; wool, 107
Philippines, sugar from, 53; trade with, 220
Phosphorus, as plant food, 27; sources, 27
Pittsburgh, iron, 151; iron smelting, 174; leading steel center, 177; river port, 203
Political map of United States, 90–91
Pork. *See* Hogs
Portland (Maine), port, 214
Portland (Oregon), trade with Far East, 220
Porto Rico, sugar, 13
Potassium, as plant food, 27; sources, 28
Potatoes, 72, 73, 74, 89
Pottery, 193–194
Poultry, 88, 90; feed for, 48
Printing press, 198
Puget Sound, 133; exports wheat and flour, 41; floating logs to, 132–133; ports, 208, 218; salmon, 94; trade with Alaska, 220

Quincy (Mass.), granite, 136; shipbuilding, 188

Railroads, 204–208; map, 207
Rails, cars and locomotives, 183–185; convertible freight cars, 184–185

Rainfall, 10–12; amount, 10, 11; Cascade Mountains, 121; east of the Rocky Mountains, 12; map, 11; of the Pacific slope, 10; between Sierra Nevada and Rocky Mountains, 12
Rantoul (Ill.), air route to, 192
Reclamation Service, 15, 16
Red River Valley, flaxseed, 118; wheat region, 35–37
Rhode Island. *See* New England
Rice, climate for, 50; on drained lands, 26; food value, 51; introduction into America, 47; planting, cultivation, and harvesting, 50; preparation for market, 50; production on reclaimed wet lands, 50; regions of production, 49, 50, 89; uses, 44
Richmond (Ind.), farm machinery, 182
Refrigerator cars, fruit transportation, 68; meat transportation, 82; vegetable carriers, 73
Relief map, 4–5
Rio Grande Irrigation Project, 15, 20
Rocky Mountains, 104; coal, 144–145; electric power, 165; forests, 121; iron ore, 178
Roosevelt Dam, 20
Rubber, from Africa and Brazil, 212; transportation route, 220; uses, 198
Russia, flax, 118; oil, 158–159; rye, 51
Rye, 51, 89

St. Louis, flour manufacture, 41; railroad center, 205–206; river port, 203
San Domingo, sugar cane from, 54
San Francisco, exports wheat and flour, 41; floating logs to, 132, 133; railroad center, 206; seaport, 213, 218, 220; shipbuilding, 188
Sand for glass, 192; in soils, 6
Savannah, 116; seaport, 213
Schenectady, locomotives, 183
Seattle (Washington), shipbuilding, 188; trade with Far East, 220
Seaweed, source of potassium, 28
Sheep, 84–87, 104–107; conditions determining location, 85, 86; in corn belt, 47; distribution in United States, 85, 104; fed on alfalfa, 86; in Northeastern states, 85, 86; producing best wool, 105–106; raising, for wool, 104–107; on range, 84–85, 105; skins for gloves, 102–104. *See* Wool
Shelter, 119–140; the modern home, 120–121; primitive homes, 2, 119; sites for homes, 119–120
Shenandoah Valley, limestone, 137
Ships, 54, 185–188, 209; battleship, 189; electrically propelled, 188; iron and steel, 185–186; launching, 186; New England clipper, 54, 209; New England lumber for, 214; New England shipbuilding, 185; speed of construction, 186, 188; *Tuckahoe*, 186–187; where constructed, 188; wooden, 185
Sierras, 12; forests on, 121
Silk, 108; from the silkworm, 108; manufacture of, in United States, 108; raw, from Japan and China, 212; sewing silk, 108
Silos, description and use, 47, 48; for dairy cattle, 77, 82
Silver, 181
Skins for clothing, 100–108
Soap, 115
Soils, 5, 32, 140; brick from clay, 134–136; clay for pottery, 193; erosion, 86; fertility, 9; glacial, 107, 214; how made, 5, 31, 32; kinds, 6–8, 31–32; map, 30–31; need of soils, 5; plant foods, 9; questions on map, 31, 32; sand for glass, 192
Sorghum, on irrigated lands, 19; regions of production, 52
South America, export of wheat and flour to, 42; future trade, 211; import of coffee and rubber, 220; wood resource, 125; wool, 107
South Carolina, cotton, 111, 113; grapes, 64; introduction of rice into, 49; pitch, tar, turpentine, 129; porcelain clays, 193; rice, 89; truck gardens, 74
South Dakota, barley, 51; coal, 145; wheat, 35
Southern pine, 129–130, 134
Statistical Appendix, 223–238
Steam power in sugar manufacturing, 53
Steel. *See* Iron and steel
Stone, 136–139, 140; artificial, 138–140; distribution, 136–137; value, 136; varieties, 136–138, 140
Storms, 10, 12; relation to rainfall, 12; sources of moisture, 10, 12; tracks of, 10
Strawberries, 68, 74
Strawberry Valley Project, 16–21
Sugar, 52–63; conservation, 52, 53; consumption, 52; crude, from Cuba, 212; map, 52; maple, 60, 61; plants from which obtained, 53; regions supplying, 53. *See* Sugar beet, Sugar cane

Sugar beet, climate for, 56; culture, 59, 60; extraction of sugar, 60; France and the, 56; potassium from, 28; refining, 20; regions of production, 52, 58; uses, 60; in Utah, 19
Sugar cane, climate suited for, 54; on drained lands, 26; extraction of sugar, 55; harvesting, 55; introduction, 54; planting, 54, 55; regions of production, 52, 54; San Domingo, 54; stalks a substitute for wood pulp, 197
Swamps, cypress, in Florida (everglades); in Louisiana, 22; peat bogs, 23
Sweden, wood resources, 125

Tar, 128; from coal, 152; creosote, 128; for dyestuffs, 152
Temperature, average seasonal, 42; influence of land and water on, 42, 43; map, 42; questions on, 42, 43
Tennessee, cotton, 111; Kingsport, 29; marble, 137; Memphis, 116
Texas, cattle, 89, 100–103; corn, 45; cotton, 89, 111; hogs, 87, 88; oil, 159, 160; peanuts, 72; pecans, 71; ranches, 78; rice, 49, 50, 89; sheep, 85; sugar cane, 54; truck gardens, 74
Titusville (Pa.), oil, 159–160
Tobacco, 27, 89, 217
Toledo, Great Lakes shipping, 204
Trade, 200–220; with Asia, 211; development of ports, 213–220; earliest routes, 200–201; Erie Canal, 203; with Europe, 209; future, 211; Great Lakes, 203, 204; on Mississippi, 202, 203; ocean commerce, 208; railroads, 204–208, 207 (map); rapid growth of commerce, 209; river and canal routes, 201–203; with South America, 211; transcontinental railways, 206
Transportation, food supply of cities dependent upon, 99; use of drainage canals for, 24. *See* Trade
Trenton (N.J.), shipbuilding, 188
Turpentine, production, 129, 130

Utah, alfalfa and honey, 61; irrigation, 13; oil, 159, 160; sheep, 85; Strawberry Valley, 16–21; sugar, 58

Valparaiso, port, 220
Vegetables, 71–74; canning, 69, 70; on drained lands, 26; food value, 72, 73; home gardens, 71, 72; shipment 73; truck gardening, 73
Vermont, maple sugar, 60; marble, 137. *See* New England
Virginia, coal, 145; peat of Dismal Swamp, 155; Saltville, 29; shipbuilding, 188; tobacco, 89; truck, 73

Washington, forests, 130; lumber, 124; wheat, 35. *See* Yakima Valley
Water power, 166–169; amount unused in United States, 169; for electricity, 17, 19, 20, 114, 166, 168; "fall line," 169; favorable regions for, 169; hydroelectric, 168; in paper manufacture, 196; St. Anthony Falls, 40; substitute for coal, 166–169
Weather Bureau, frost warnings, 66
West Indies, cane sugar, 54
West Virginia, coal, 145; natural gas, 141, 165; oil field, 159, 160
Wet lands, 22, 26; kinds, 22, 23; location, 22, 23; methods of drainage, 25; products, 25, 26, 65; value of drainage, 24, 25. *See also* Peat
Wheat, 33–43, 89; areas of production, 34–36; decreased cost of production, 38, 39; early history, 33; export, 41, 42; growth, 36–37; harvesting, 37; on irrigated lands, 19; manufacture into flour, 40, 41; in New England, 33; planting, 36; questions on production, 35; in Red River Valley, 35, 36; soil and climate for, 34, 43; storage, 39, 40; substitute for, 71; transportation, 41, 42, 46; varieties, 35
Wilmington (Del.), shipbuilding, 188
Winds, influence on rainfall, 10, 12; influence on temperature, 43
Wisconsin, dairy products, 83, 84; hay, 89; hogs, 87, 88; lumber industry, 123; potassium, 28
Wood, 140; charcoal, 143, 175; as fuel, 141–142; varieties in modern house, 134. *See also* Forests
Wood pulp, from Canada, 212; for paper, 195; substitutes for, 197
Wool, 104–108; carpets, 107; cleaning, scouring, bleaching, 106; clothing, 2; felt, 107; grease, 106; manufacturing, 104, 106, 107; in paper-making, 194; scarcity, 107; shawls, 107; sheep-raising for, 104–107; shoddy, 107; from southern hemisphere, 107, 212; trade in, 220; usefulness, 104, 106–107. *See* Sheep
Wyoming, coal, 145; oil, 159–160; sheep, 85, 105

Yakima Valley apples, 65, 89
Yuma, 112

159010

G.
Fis.

Author Fisher, Elizabeth Florette

Title Resources and industries of the United States.

DATE.	NAME OF BORROWER.
Apr 8/24	Beatty

University of Toronto Library

DO NOT REMOVE THE CARD FROM THIS POCKET

Acme Library Card Pocket
Under Pat. "Ref. Index File"
Made by LIBRARY BUREAU